

EXHIBIT 7

**UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION**

XR COMMUNICATIONS D/B/A VIVATO
TECHNOLOGIES,

Plaintiff,

v.

AT&T SERVICES INC; AT&T MOBILITY
LLC; and AT&T CORP.,

Defendants.

Case No. 2:23-cv-00202-JRG-RSP

LEAD CASE

XR COMMUNICATIONS D/B/A VIVATO
TECHNOLOGIES,

Plaintiff,

v.

VERIZON COMMUNICATIONS, INC.,
CELLCO PARTNERSHIP D/B/A VERIZON
WIRELESS,

Defendants.

Case No. 2:23-cv-00203-JRG-RSP

MEMBER CASE

XR COMMUNICATIONS D/B/A VIVATO
TECHNOLOGIES,

Plaintiff,

v.

T-MOBILE USA, INC.,

Defendant.

Case No. 2:23-cv-00204-JRG-RSP

MEMBER CASE

DEFENDANTS' FIRST AMENDED P.R. 3-3 AND 3-4 DISCLOSURES

I. INTRODUCTION

Pursuant to P.R. 3-6, Defendants AT&T Services, Inc., AT&T Mobility LLC, and AT&T Corp. (collectively, "AT&T"); Defendants Verizon Communications, Inc. and Cellco Partnership

d/b/a Verizon Wireless (collectively, “Verizon”); Defendant T-Mobile USA, Inc. (“T-Mobile”); Intervenor Nokia of America Corporation (“Nokia”); and Intervenor Ericsson, Inc. (“Ericsson”) (all defendants and intervenors collectively, “Defendants”) hereby disclose their First Amended P.R. 3-3 and 3-4 disclosures (“Invalidity Contentions”) in view of XR Communications d/b/a Vivato Technologies’ various P.R. 3-1 Disclosure of Asserted Claims and Infringement Contentions (collectively, “Infringement Contentions”), served July 28, 2023 and amended on August 31, 2023, and in view of the Court’s November 14, 2024 Claim Construction Order. In the event that XR Communications d/b/a Vivato Technologies (“XR”) is granted leave to amend further its Infringement Contentions or its infringement theories, these Invalidity Contentions may change, and Defendants reserve the right to amend or supplement these Invalidity Contentions.

Defendants contend that each of the Asserted Claims (as defined below) by XR is invalid under 35 U.S.C. §§ 102, 103, and/or 112 for at least the reasons provided below.¹

A. Asserted Claims

XR served Infringement Contentions alleging infringement of the following patents and claims (collectively, the “Asserted Patents” and “Asserted Claims”):

- Claims 1-5, 8-12, and 15-19 of U.S. Patent No. 10,715,235 (the ‘235 Patent”);
- Claims 15, 17, 20-22, 30, and 33-35 of U.S. Patent No. 8,289,939 (the “’939 Patent”);
- Claims 1-9, 12-18, and 22-34 of U.S. Patent No. 10,594,376 (the “’376 Patent”);
- Claims 1, 2, 4-6, 9-11, 13-15, and 18-20 of U.S. Patent No. 8,737,511 (the “’511 Patent”); and
- Claims 1-7, 9, 10, 12-15, 19, 21, 28, 32, 33, 35-37, and 41 of U.S. Patent No. 7,177,369 (the “’369 Patent”).

¹ All Asserted Patents have a priority dates prior to March 16, 2013. Accordingly, all references to 35 U.S.C. §102 refer to the pre-AIA version of that statute defining prior art.

These Invalidity Contentions address only the Asserted Claims specifically set forth in XR's Infringement Contentions. Defendants do not concede that the claims that XR has not asserted are valid and reserve all rights to amend these contentions if XR asserts additional claims and/or patents.

B. Ongoing Discovery and Disclosures

Defendants base their Invalidity Contentions on their current knowledge and understanding of the Asserted Claims and review of prior art, as of the date of these Invalidity Contentions. Defendants' Invalidity Contentions are made without the benefit of discovery regarding the parties' claim construction contentions, expert discovery, third-party discovery, and claim construction opinion or order by the Court. These Invalidity Contentions are provided without prejudice to Defendants' right to revise, amend, correct, supplement, modify, or clarify their Invalidity Contentions.

Defendants also base their Invalidity Contentions on their current understanding of the Asserted Claims in view of XR's Infringement Contentions. XR's Infringement Contentions are both facially and substantively deficient as reflected in the August 17, 2023, correspondence from Defendants' counsel to Plaintiff's counsel regarding exemplary deficiencies in the Infringement Contentions. While XR amended its Infringement Contentions in response to this correspondence, those amendments did not address many of the identified issues and XR has not yet provided a complete mapping for any specific device or address any of the other deficiencies noted above. Defendants reserve all of their rights both to seek leave to amend or supplement and to amend or supplement these contentions if XR supplements or amends its infringement contentions or otherwise responds to address any deficiency.

Defendants incorporate by reference all other bases for invalidity identified in Defendants' Answers, Initial Disclosures, and interrogatory responses in this matter, and the prosecution or

post-grant review (e.g., during *Inter Partes* Review) of the Asserted Patents and all related patents and/or patent applications, including but not limited to statements made by both the patent applicant and patent examiners, and references cited therein.

Defendants further incorporate by reference all admissions regarding the Asserted Patents including, but not limited to, admissions in the specification of the Asserted Patents, and the prosecution or post-grant review of the Asserted Patents and related patents and/or patent applications. Defendants further incorporate any and all invalidity contentions previously served or subsequently served in any related litigation, or served in any prior litigation involving the Asserted Patents and related patents (collectively, the “Other Actions”).

C. Claim Construction

The Court issued its claim construction order on November 14, 2024. These First Amended Invalidity Contentions are submitted in view of the Court’s Claim Construction Order, pursuant to P.R. 3-6. In some instances, Defendants map the prior art references to the Asserted Claims based on XR’s apparent interpretation of the claims and the Court’s Claim Construction Order, to the extent understood, of the Asserted Claims as advanced in XR’s Infringement Contentions. However, nothing stated in this document or accompanying claim charts should be treated as an admission or suggestion that XR’s apparent interpretation of the claims and the Court’s Claim Construction Order is correct, or that any claim terms of the Asserted Claims are not invalid under 35 U.S.C. § 112 for being indefinite, failing to satisfy the written description requirement, or failing to satisfy the enablement requirement. In fact, Defendants specifically deny that XR’s apparent interpretation of the claims and the Court’s Claim Construction Order.

Depending on the positions that XR or its expert witness(es) may take concerning claim interpretation, infringement, and/or invalidity issues, the asserted prior art references may be of greater or lesser relevance. Given this uncertainty, the charts may reflect alternative applications

of the prior art against the Asserted Claims. Thus, no chart or position taken by Defendants should be construed as an admission or a waiver of any particular construction of any claim term. Defendants also reserve the right to challenge any of the claim terms under 35 U.S.C. § 112, including by arguing that they are indefinite, not supported by the written description, and/or not enabled.

D. Effective Dates

XR asserted under P.R. 3-1(e) that the Asserted Claims of the '376 and '235 Patents are entitled to a priority date of February 1, 2002. Defendants contest XR's alleged priority date. The '376 and '235 Patents are entitled to a priority date of no earlier than November 3, 2003.

XR asserted under P.R. 3-1(e) that the Asserted Claims of the '939 Patent are entitled to a priority date of November 4, 2002. Defendants contest XR's alleged priority date. The '939 Patent is entitled to a priority date of no earlier than November 3, 2003.

XR asserted under P.R. 3-1(e) that the Asserted Claims of the '369 Patent are entitled to a priority date of April 27, 2001. Defendants contest XR's alleged priority date. The '369 Patent is entitled to a priority date of no earlier than April 25, 2002.

XR asserted under P.R. 3-1(e) that the Asserted Claims of the '511 Patent are entitled to a priority date of April 13, 2012. The '511 Patent is entitled to a priority date of no earlier than April 13, 2012.

Defendants contest XR's claimed priority dates as new matter was added to the specification of the Asserted Patents through later-filed applications disclosing new matter that was incorporated into the Asserted Claims. Defendants reserve the right to rely on prior art dated after XR's claimed priority date to the extent XR fails to prove entitlement to the above priority dates for any Asserted Claim. To the extent XR in the future seeks and is granted leave to amend its disclosures in an attempt to establish an earlier effective date, Defendants reserve the right to

amend these contentions in response, including by disclosing additional prior art or earlier versions or evidence of the prior art disclosed herein.

E. Prior Art Identification and Citation

The accompanying invalidity claim charts (Exhibits A-E) cite to particular teachings and disclosures of the prior art references as applied to features of the Asserted Claims. However, persons having ordinary skill in the art may view an item of prior art generally in the context of other publications, literature, products, and understanding. Accordingly, the cited portions are only exemplary and are intended to put XR on notice of the basis for Defendants' contentions. Defendants have endeavored to identify the most relevant portions of the references, but the references may contain additional support for particular claim limitations. Defendants reserve the right to rely on uncited portions of the prior art references, other documents, and/or operational systems, as well as fact and expert testimony, to provide context or to aid in understanding the cited portions of the references and interpreting the teachings of the prior art and to establish bases for combinations of certain cited references that render the Asserted Claims obvious.

Defendants reserve the right to rely on any prior art system referenced, embodied, or described in any of the prior art references identified herein, or which embodies any of the prior art references identified herein. Moreover, Defendants reserve the right to rely on inventor admissions concerning the scope of the prior art relevant to the asserted patents found in, *inter alia*, the prosecution histories or post-grant review proceedings of the asserted patents and related patents and/or patent applications, any testimony or declarations of the named inventors concerning the asserted patents or related patents, and any papers or evidence submitted by XR in connection with this litigation, any other pending or future litigation brought by XR involving the asserted patents or related patents. Defendants also may establish what was known to a person

having ordinary skill in the art through treatises, published industry standards other publications, products, and/or testimony.

Where the invalidity claim charts (Exhibits A-E) cite to a particular figure in a reference, the citation should be understood to encompass the caption of the figure and other text relating to and/or describing the figure. Similarly, where the invalidity claim charts cite to particular text referring to a figure, the citation should be understood to include the figure and related figures as well.

The prior art references listed herein and in the accompanying claim charts may disclose the elements of the Asserted Claims explicitly and/or inherently. The prior art references are also relevant for their showing of the state of the art and reasons and motivations for making improvements, additions, and combinations. The suggested obviousness combinations are provided in the alternative to Defendants' anticipation contentions and are not to be construed to suggest that any reference is not itself anticipatory.

Further, the combinations of prior art references contained herein demonstrating the obviousness of the Asserted Patents under 35 U.S.C. § 103 are merely exemplary and are not intended to be exhaustive. All such combinations are intended to include and are in view of the knowledge of a person of ordinary skill in the art. Additional obviousness combinations of the identified prior art references are possible, and Defendants reserve the right to use any such combination(s) in this Action. In particular, Defendants are currently unaware of the extent, if any, to which XR will contend that limitations of any particular claim(s) is/are not disclosed in the art that Defendants have identified as anticipatory. To the extent that XR does so, Defendants reserve the right to identify other evidence or references that anticipate or render obvious the particular claim(s).

Nothing in these Invalidity Contentions should be treated as an admission that any of Defendants' accused instrumentalities meet any limitation of the Asserted Claims. Defendants deny infringing the Asserted Claims. To the extent that any prior art reference identified by Defendants contains a claim element that is the same as or similar to an element in an accused instrumentality, based on a claim construction inferred from XR's Infringement Contentions, inclusion of that reference in Defendants' Invalidity Contentions is not a waiver by Defendants of any claim construction or non-infringement position, nor is it an admission or suggestion by Defendants that any accused instrumentality satisfies the limitations of the Asserted Claims under a proper construction of those claims.

F. Lack of Inventorship and Proper Ownership

Defendants reserve the right to assert that the Asserted Claims are invalid under 35 U.S.C. § 102(f) and/or § 102(g) in the event that Defendants obtain evidence that the named inventor of the Asserted Patents did not invent (either alone or in conjunction with other parties) the subject matter claimed in the Asserted Patents. Should Defendants obtain such evidence, Defendants will provide the name of the person(s) from whom and the circumstances under which the invention or any part of it was derived, and/or the circumstances surrounding the making of the invention before the patent application.

G. Additional Reservation of Rights

Defendants' identification in the prior art of claim elements recited in the preamble of any claims is not intended to indicate that any such preamble is limiting. All such disclosures are made only to the extent the preamble is determined to be limiting.

As described above, Defendants also intend to diligently seek discovery from third parties to demonstrate the inventions were known or used by others under 35 U.S.C. § 102(a), in public use and/or on-sale under 35 U.S.C. § 102(b), and/or earlier invention of the claimed inventions

under 35 U.S.C. § 102(g). Defendants may therefore modify, amend, and/or supplement these Invalidity Contentions if and when further information becomes available.

Additionally, Defendants incorporate by reference into these contentions every claim element cross-referenced in XR's Infringement Contentions. For any element in XR's Infringement Contentions for which XR refers to the information from one or more other elements (whether in the same or a different patent), Defendants incorporate by reference the same cross-reference for these contentions.

Subject to the foregoing statements and qualifications, Defendants provide the following disclosures.

II. P.R. 3-3 DISCLOSURES AND CONTENTIONS

The following Exhibits (also referred to as Appendices) include claim charts of prior art references that, alone and/or in combination with other references, render the Asserted Claims of the Asserted Patents invalid under §§ 102 or 103, and further include (directly and/or in combination with the corresponding subparts of Sections II.B. of this document) secondary references that would have been obvious to combine with the charted prior art references and motivations for making such combinations.

Exhibit A	U.S. Patent No. 10,715,235 ("the '235 Patent")
Exhibit B	U.S. Patent No. 8,289,939 ("the '939 Patent")
Exhibit C	U.S. Patent No. 10,594,376 ("the '376 Patent")
Exhibit D	U.S. Patent No. 8,737,511 ("the '511 Patent")
Exhibit E	U.S. Patent No. 7,177,369 ("the '369 Patent")

A. P.R. 3-3(a) Disclosures: Identification of Items of Prior Art that Anticipate

Subject to Defendants' reservation of rights, Defendants contend that the following prior art patents, printed publications, and systems, alone and/or in combination, anticipate and/or render obvious the Asserted Claims of the Asserted Patents.

As noted above, however, discovery is ongoing, and Defendants' prior art investigation and third party discovery are therefore not yet complete. Accordingly, Defendants reserve the right to present additional items of prior art under 35 U.S.C. § 102(a), (b), (e), (f) and/or (g), and/or § 103 located during the course of discovery or further investigation. In addition, Defendants reserve the right to assert invalidity under 35 U.S.C. §§ 102(c) or (d) to the extent that discovery or further investigation yields information forming the basis for such invalidity.

While the categories of art (patents/applications, non-patent publications, and systems) below are organized by asserted patent number, because of the overlapping nature of the asserted patents, Defendants identify each reference in each category as art applicable to each of the asserted patents.

1. Prior Art Patents and Published Patent Applications

Defendants disclose the following patents and patent application publications:

a. The '235 Patent

Exh.	Patent/Publication No.	Country of Origin	Named Inventor	Issue / Publication Date	Short Title
A01	USP 7,224,758	U.S.	Brian Banister	May 29, 2007	Banister 758
A02	USP 6,738,020	U.S.	Eric D. Lindskog, Mitchell D. Trott, Hafedh Trigui, Serge de la Barbosa	May 18, 2004	Lindskog

Exh.	Patent/Publication No.	Country of Origin	Named Inventor	Issue / Publication Date	Short Title
A03	USP 6,888,809	U.S.	Gerard Joseph Foschini, Angel Lozano, Farrokh Rashid-Farrokh, Reinaldo A. Valenzuela	May 3, 2005	Foschini
A04	USPP 2001/003164 7	U.S.	Shimon Scherzer, Piu Wong	October 18, 2001	Scherzer 647
A05	USP 6,124,824	U.S.	Guanghan Xu, Daniel Wee, Ying Chen, Yong Rao	September 26, 2000	Xu
A06	USP 6,175,550	U.S.	Richard van Nee	January 16, 2001	van Nee
A07	USP 7,139,324	U.S.	Juha Ylitalo, Marcos Katz	November 21, 2006	Ylitalo
A08	USPP 2003/006898 3	U.S.	Sung-jin Kim, Ju-Ho Lee, Jong-Hyeuk Lee, Yong-Suk Lee, Ki-ho Kim, Hyeon-Woo Lee	April 10, 2003	Kim 983
A09	USPP 2002/019090 1	U.S.	Shousei Yoshida	February 19, 2002	Yoshida 901
A10	USPP 2008/017053 3	U.S.	Haruch Cyzs, Haim Grinberger	July 17, 2008	Cyzs
A11	PCT Pub. WO20000010 78A1	PCT	Robert Harrison	January 6, 2000	Harrison
A12	USPP 2002/006064 3	U.S.	Shmuel Levy, Noam Livneh, Ori Stern, Ami Saguy	May 23, 2002	Levy 643
A13	PCT Pub. No. WO20020472 86A2	PCT	Ari Hottinen, Risto Wichman, Olav Tirkkonen	June 13, 2002	Hottinen 286
A14	USP 7,155,231	U.S.	Joseph P. Burke, Michael J. Wengler, Bhaskar D. Rao, Harris S. Simon	December 26, 2006	Burke

Exh.	Patent/Publication No.	Country of Origin	Named Inventor	Issue / Publication Date	Short Title
A15	USP 5,933,421	U.S.	Siavash Alamouti, Eduardo F. Casas, Michael Hirano, Elliott Hoole, Mary Jesse, David G. Michelson, Patrick Poon, Gregory J. Veintimilla, Hongliang Zhang	August 3, 1999	Alamouti
A17	USP 6,141,335	U.S.	Mikio Kuwahara, Seishi Hanaoka, Nobukazu Doi, Takaki Uta	October 31, 2000	Kuwahara
A18	USP 6,067,290	U.S.	Arogyaswami J. Paulraj, Robert W. Heath, Jr., Peroor K. Sebastian, David J. Gesbert	May 23, 2000	Paulraj 290
A20	USP 5,828,658	U.S.	Bjorn E. Ottersten, Craig H. Barratt, David M. Parish, Richard H. Roy, III	October 27, 2000	Ottersten
A22	USP 5,471,647	U.S.	Derek Gerlach, Arogyaswami Paulraj	November 28, 1995	Gerlach 647
A23	USPP 2002/001853 0	U.S.	Sung-jin Kim, Kwang- bok Lee, Hyeon-Woo Lee, Keun-chul Hwang, Ho-Kyu Choi, Yong- Suk Lee	February 14, 2002	Kim 530
A26	USP 6,947,707	U.S.	Balaji Raghothaman	September 20, 2005	Raghothaman
A27	USP 6,533,012	U.S.	Marcos Katz	April 22, 2003	Katz
A29	USP 6,473,036 / USPP 2003/012504 0	U.S.	Jay Walton, Mark Wallace, Steven Howard	July 3, 2003	Walton 040
A30	USP 7,248,841	U.S.	Brian Agee, Matthew Bromberg	July 24, 2007	Agee 841

Exh.	Patent/Publication No.	Country of Origin	Named Inventor	Issue / Publication Date	Short Title
A32	USP 6,317,586	U.S.	Martin Haardt	November 13, 2001	Haardt 586
A33	USP 6,141,567	U.S.	Michael Youssefmir, Mitchell D. Trott, Kamaraj Karuppiah, Paul Petrus	October 31, 2000	Youssefmir 567
A34	USPP 2004/001881 8	U.S.	Ari Hottinen, Risto Wichman, Olay Tirkkonen	January 29, 2004	Hottinen 818
A35	USP 6,031,877	U.S.	Simon Saunders	February 29, 2000	Saunders 877
A36	Japanese Patent Pub. JP200229031 7A	Japan	Daisuke Jitsukawa, Hiroyuki Seti, Yoshiaki Tanaka	October 4, 2002	Jitsukawa
A37	USPP 2002/013138 1	U.S.	Sung-jin Kim, Yong- Suk Lee, Sung-Ho Choi, Hyun-woo Lee, Sung- Oh Hwang, Byung-Jae Kwak, Yong-Jun Kwak, Sang-Hwan Park	September 19, 2002	Kim 381
A38	USP 7,116,723	U.S.	Sung-jin Kim, Kwang- bok Lee, Hyeon-Woo Lee, Keun-chul Hwang, Ho-Kyu Choi, Yong- Suk Lee	October 3, 2006	Kim 723
A40	USPP 2002/015880 1	U.S.	William Crilly, Ken Biba, Robert Conley	October 31, 2002	Crilly
A41	USP 5,634,199	U.S.	Derek Gerlach, Arogyaswami Paulraj, Gregory G. Raleigh	May 27, 1997	Gerlach 199
A42	USP 6,895,258	U.S.	Shimon Scherzer, Piu Wong	May 17, 2005	Scherzer 258
A43	USP 6,760,388	U.S.	John Ketchum, Mark Wallace, Steven Howard, Jay Walton	July 6, 2004	Ketchum

Exh.	Patent/Publication No.	Country of Origin	Named Inventor	Issue / Publication Date	Short Title
A44	USP 6,359,923	U.S.	Brian G. Agee, Matthew Bromberg, Derek Gerlach, David Gibbons, James Timothy Golden, Minnie Ho, Elliott Hoole, Mary Jesse, Robert Lee Maxwell, Robert G. Mechaley, Jr., Robert Ray Naish, David J. Nix, David James Ryan, David Stephenson	March 19, 2002	Agee 923
A45	USP 6,473,036	U.S.	James Proctor, Jr.	October 29, 2002	Proctor 036

b. The '939 Patent

Exh.	Patent/Publication No.	Country of Origin	Named Inventors	Issue Date / Publication Date	Short Title
B01	USPP 2002/007594 1	U.S.	Slim Souissi, Leo Dehner, Eric Meihofner	June 20, 2002	Souissi
B02	USPP 2003/003640 8	U.S.	Lars Johansson, Robert Gessel, Wallace Watson, Daniel Carlson, Benjamin Roderique	February 20, 2003	Johansson
B03	USP 7,158,501	U.S.	Hideo Kasami, Kuniaki Ito, Kiyoshi Toshimitsu	December 5, 2002	Kasami '501
B04	USP 7,042,860	U.S.	Hideo Kasami, Shuichi Obayashi	May 9, 2006	Kasami '860
B05	USP 6,859,450	U.S.	Carl Mansfield	February 22, 2005	Mansfield
B06	USP 5,907,544	U.S.	Chandos A. Rypinski	May 25, 1999	Rypinski
B07	USPP 2004/003725 8	U.S.	Shimon Scherzer, Patrick Worfolk	February 26, 2004	Scherzer
B08	USP 5,933,420	U.S.	Gary M. Jaszewski, David A. Fisher, Richard C. Chambers	August 3, 1999	Jaszewski

Exh.	Patent/Publication No.	Country of Origin	Named Inventors	Issue Date / Publication Date	Short Title
B09	USP 7,158,759	U.S.	Christopher J. Hansen, Joonsuk Kim, Matthew Fischer, Rajugopal Gubbi, Jason A. Trachewsky	January 2, 2007	Hansen
B10	USP 7,499,964	U.S.	Patrick Busch, Richa Malhotra	March 3, 2009	Busch
B17	USP 7,039,441	U.S.	Douglas Reudink, Mark Reudink	May 2, 2006	Reudink
B19	USP 5,701,590	U.S.	Satoshi Fujinami	December 23, 1997	Fujinami
B20	USP 6,246,881	U.S.	Janne Parantainen, Oscar Salonaho	June 12, 2001	Parantainen
B21	USPP 2002/000205 2	U.S.	Mark McHenry	January 3, 2002	McHenry
B22	USP 7,983,688	U.S.	David Gibbons, Eamonn Gormley, Liang Hong, Elliott Hoole, Kamyar Moinzadeh	July 19, 2011	Gibbons
B23	USP 8,638,877	U.S.	James Proctor	January 28, 2014	Proctor
B24	USP 6,788,943	U.S.	Seppo Hamalainen, Oscar Salonaho, Niina Laaksonen, Antti Lappetelainen	September 7, 2004	Hamalainen
B25	USP 6,731,939	U.S.	Fujio Watanabe, Arto Palin, Takako Sanda	May 4, 2004	Watanabe
B26	USPP 2002/004158 4	U.S.	Toshiyuki Sashihara	April 11, 2002	Sashihara

c. **The '376 Patent**

Exh.	Patent/Publication No.	Country of Origin	Inventor	Issue Date/ Publication Date	Short Title
C01	U.S. 2003/001785 3	U.S.	Sridhar Kanamaluru, Zygmund Turski, Henry Owen	January 23, 2003	Kanamaluru
C02	U.S. 6,553,012	U.S.	Marcos Katz	April 22, 2003	Katz

Exh.	Patent/Publication No.	Country of Origin	Inventor	Issue Date/Publication Date	Short Title
C03	U.S. 6,970,722	U.S.	Michael Lewis	November 29, 2005	Lewis
C04	U.S. 7,158,501	U.S.	Hideo Kasami, Kuniaki Ito, Kiyoshi Toshimitsu, Tomoko Adachi	January 2, 2007	Kasami '501
C05	U.S. 7,263,385	U.S.	Mehmet Izzet Gurelli, Raul Hernan Etkin	August 28, 2007	Gurelli
C06	U.S. 5,471,647	U.S.	Derek Gerlach, Arogyaswami Paulraj	November 28, 1995	Gerlach '647
C07	U.S. 5,634,199	U.S.	Derek Gerlach, Arogyaswami Paulraj, Gregory G. Raleigh	May 27, 1997	Gerlach '199
C08	U.S. 2002/015880 1	U.S.	William Crilly, Ken Biba, Robert Conley	October 31, 2002	Crilly
C09	U.S. 6,895,253	U.S.	Manuel Joseph Carloni, Michael James Gans, Reinaldo A. Valenzuela, Jack Harriman Winters	May 17, 2005	Carloni
C10	U.S. 7,042,394	U.S.	Ian Sayers	May 9, 2006	Sayers
C11	U.S. 2002/004143 0	U.S.	Hideo Kasami, Shuichi Obayashi	May 9, 2006	Kasami '430
C12	U.S. 2003/006020 5	U.S.	Joseph Shapira	March 27, 2003	Shapira
C13	U.S. 6,738,020	U.S.	Eric D. Lindskog, Mitchell D. Trott, Hamed Trigui, Serge de la Barbosa	May 18, 2004	Lindskog
C14	U.S. 6,795,409	U.S.	Michael Youssefmir, Mitchell D. Trott, Roger Rogard	September 21, 2004	Youssefmir

Exh.	Patent/Publication No.	Country of Origin	Inventor	Issue Date/Publication Date	Short Title
C15	U.S. 6,359,923	U.S.	Brian G. Agee, Matthew Bromberg, Derek Gerlach, David Gibbons, James Timothy Golden, Minnie Ho, Elliott Hoole, Mary Jesse, Robert Lee Maxwell, Robert G. Mechaley, Jr., Robert Ray Naish, David J. Nix, David James Ryan, David Stephenson	March 19, 2002	Agee
C16	U.S. 7,039,441	U.S.	Douglas O. Reudink, Mark D. Reudink	May 2, 2006	Reudink
C17	U.S. 5,592,490	U.S.	Craig H. Barratt, David M. Parish, Richard H. Roy, III	January 7, 1997	Barratt
C26	U.S. 7,529,525	U.S.	Omri Hovers, Shahar Kagan, Nanu Peri, Milena Chechik	May 5, 2009	Hovers
C27	USP 6,927,728	U.S.	Frederick W. Vook, Timothy A. Thomas, Xiangyang Zhuang	August 9, 2005	Vook

d. The '511 Patent

Exh.	Patent/Publication No.	Country of Origin	First Named Inventor	Issue Date	Relevant Priority Date	Short Title
D01	USPP 2009/028086 6	U.S.	Lo	November 12, 2009 (published)	November 14, 2006	Lo
D02	USPP 2011/015005 0	U.S.	Trigui	June 23, 2011 (published)	December 23, 2009	Trigui
D03	USPP 2006/016672 1	U.S.	Sun	July 27, 2006	October 31, 2005	Sun

Exh.	Patent/Publication No.	Country of Origin	First Named Inventor	Issue Date	Relevant Priority Date	Short Title
D04	USPP 2007/028038 7	U..S	Li	December 6, 2007	May 24, 2007	Li
D05	USP 7,620,370	U.S.	Barak	November 17, 2009	January 15, 2007	Barak
D06	USP 9,252,908	U.S.	Branlund	February 2, 2016	April 12, 2012	Branlund
D07	USP 8,238,318	U.S.	Negus	August 7, 2012	August 17, 2011	Negus
D08	USP 8,816,907	U.S.	Beaudin	August 26, 2014	November 7, 2011	Beaudin
D09	USPP 2009/032260 8	U.S.	Adams	December 31, 2009	June 25, 2008	Adams
D09	USPP 2002/013260 0	U.S	Rudrapatna	September 19, 2002	January 17, 2001	Rudrapatna

In addition, the following references are discussed in the Obviousness section below, but are not separately charted in an exhibit.

Exh.	Patent No.	Country of Origin	First Named Inventor	Issue Date	Relevant Priority Date	Short Title
	USP 8,442,449	U.S.	Hui	May 14, 2003	November 8, 2010	Hui
	USP 6,870,515	U.S.	Kitchener	March 22, 2005	October 11, 2001	Kitchener 515
	USP 8,134,504	U.S.	Xu	March 13, 2012	December 1, 2009	Xu 504
	USP 7,565,143	U.S.	Takeuchi	July 21, 2009	March 28, 2006	Takeuchi
	USP 8,654,815	U.S.	Forenza	February 18, 2014	December 3, 2009	Forenza

Exh.	Patent No.	Country of Origin	First Named Inventor	Issue Date	Relevant Priority Date	Short Title
	USP 6,359,923	U.S.	Agee	March 19, 2002	December 18, 1997	Agee 923
	USPP 2002/013260 0	U.S.	Rudrapatna	September 19, 2002 (published)	January 17, 2001	Rudrapatna
	USPP 2009/032260 8	U.S.	Adams	December 31, 2009	June 25, 2008	Adams
	USP 7,248,841	U.S.	Brian Agee, Matthew Bromberg	July 24, 2007	June 10, 2001	Agee 841
	USPP 2009/001035 6	U.S.	Engstrom	January 8, 2009	January 4, 2006	Engstrom
	USP 6,611,231	U.S.	Crilly	August 26, 2003	October 12, 2001	Crilly
	USP 8,204,151	U.S.	Kim	June 19, 2012	January 8, 2009	Kim
	USP 8,879,470	U.S.	Zhang	November 4, 2014	February 27, 2009	Zhang
	USP 8,385,305	U.S.	Negus	February 26, 2013	April 16, 2012	Negus '305
	USP 8,649,418	U.S.	Negus	February 11, 2014	February 2, 2013	Negus '418
	USP 8,989,762	U.S.	Negus	March 24, 2015	December 5, 2013	Negus '762
	USP 8,502,733	U.S.	Negus	August 6, 2013	February 10, 2012	Negus '733
	USP 8,422,540	U.S.	Negus	April 16, 2013	September 10, 2012 ²	Negus '540
	USP 8,761,100	U.S.	Negus	June 24, 2014	October 11, 2011	Negus '100

² Claiming priority to Provisional application No. 61/662,809, filed on Jun. 21, 2012, provisional application No. 61/663,461, filed on Jun. 22, 2012.

The following Negus patents are all prior art under at least sections 102(a)(e)(g): Negus '733, Negus '100. The following patents are offered furthermore as state of the art for obviousness: Negus '305, Negus '418, Negus '762, Negus '540.

Each of the other references is prior art under section 102(a) and (e). Furthermore, the following references are prior under section 102(b): Kitchener 515, Takeuchi, Agee 923, Agee 841, Rudrapatna, Adams, Engstrom, Crilly.

e. The '369 Patent

Exh.	Patent/Publication No.	Country of Origin	First Named Inventor	Issue Date	Relevant Priority Date	Short Title
E01	USP 6,947,748	U.S.	Li	September 20, 2005	December 15, 2000	Li 748
E02	USP 6,940,827	U.S.	Li	September 6, 2005	March 9, 2001	Li 827
E04	USP 6,359,923	U.S.	Agee	March 19, 2002	December 18, 1997	Agee 923
E04	USP 6,252,914	U.S.	Yamamoto	June 26, 2001	July 20, 1999	Yamamoto

2. Prior Art Non-Patent Publications

In addition to the patents and patent and patent application publications, Defendants disclose the following additional publications:

a. The '235 Patent

Exh.	Title	Author / Publisher	Date Published	Short Title
A16	3GPP TSG RAN WG1 R1-99c10	Motorola	August 30-September 3, 1999	Motorola 3GPP
A19	Space-Time Signaling in Multi-Antenna Systems	Robert W. Heath Jr.	November 2001	Heath 2001

Exh.	Title	Author / Publisher	Date Published	Short Title
A21	Won Mee Jang et al., Joint Transmitter-Receiver Optimization in Synchronous Multiuser Communications over Multipath Channels, 46 IEEE Trans. Comm. 269	Won Mee Jang, Branimir R. Vojcic, Raymond Pickholtz	February 1998	Jang
A24	Ari Hottinen and Risto Wichman, Transmit Diversity Using Filtered Feedback Weights in the FDD/WCDMA System, 2000 Int'l Zurich Seminar on Broadband Commc's Accessing Transmission Network Proceedings 15	Ari Hottinen, Risto Wichman	2000	Hottinen 2000
A25	Derek Gerlach and Arogyaswami Paulraj, Base Station Transmitter Antenna Arrays with Mobile to Base Feedback, 1993 Asilomar Conf. on Signals Systems and Computers 1432	Derek Gerlach, Arogyaswami Paulraj	1993	Gerlach 1993
A28	R. Thomas Dewberry et al., Transmit Diversity in 3G CDMA Systems, 40 IEEE Commc'ns Magazine 68, April 2002	R. Thomas Dewberry, Steven D. Gray, D. Mihai Ionescu, Giridhar Mandyam, Balaji Raghothaman	April 2002	Derryberry
A31	Pramod Viswanath et al, Opportunistic Beamforming Using Dumb Antennas, 48 IEEE Trans. on Information Theory 1277	Pramod Viswanath, David N. C. Tse, Rajiv Laroia	June 2002	Viswanath
A39	Banister, Brian Clarke, "Feedback Assisted Multi-Antenna Transmission Weight Adaptation for Wireless Communications"	Brian Clarke Banister	2002	Banister 2002

b. The '939 Patent

Exh.	Title	Author / Publisher	Date Published	Short Title
B11	IEEE Standard 802.11, 1999 Edition, Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications	IEEE	1999	802.11-1999
B12	Transmitter Power Control (TPC) and Dynamic Frequency Selection (DFS) Joint Proposal for 802.11h WLAN, IEEE 802.11/01/169r2	S. Choi, S. Gray, M. Kasslin, S. Mangold, A. Soomro, Andrew Myles, David Skellern, Peter Ecclesine, Philips Research, Nokia Research Center, ComNets Aachen University, Cisco	May 16, 2001	802.11h Proposal
B13	Evaluation of Interference Between Uplink and Downlink in UTRA/TDD, 5 IEEE VTS 2616	Harri Holma, Gordon J. R. Povey, Antti Toskala	1999	Holma
B14	Channel Assignment Schemes for Cellular Mobile Telecommunication Systems: A Comprehensive Survey, IEEE Personal Communications 10	I. Katzela, M. Naghshineh	1996	Katzela
B15	The Mobile Communications Handbook, 2d ed.	Jerry D. Gibson ed.	1999	Gibson
B16	Frequency Reuse and System Deployment in Local Multipoint Distribution Service, 6 IEEE Personal Commc'ns 20	Vincentzio I. Roman	1999	Roman

Exh.	Title	Author / Publisher	Date Published	Short Title
B27	GSM Networks: Protocols, Terminology, and Implementation	Gunnar Heine/Artech House	1999 (German version in 1998)	Heine
B29	“Smart Antennas for Wireless Communications: IS-95 and Third Generation Cdma Applications”, 1 st Edition	Liberti/Pearson College Div	1999	Liberti

c. The '376 Patent

Exh.	Title	Author / Publisher	Date Published	Short Title
C18	Impact of Closed-Loop Power Control on SDMA-TDMA System Performance, Proc. IEEE Vehicular Tech. Conf. (2002)	Yunjian Jia, Shinsuke Hara, Yoshitaka Hara	September 28, 2002	Jia
C19	A Dynamic Channel Assignment Algorithm for Cellular System with Adaptive Array Antennas, IEEE Vehicular Tech. Conf. (1999)	Lan Chen, Hidekasu Marata, Susumu Yoshida, Shouichi Hirose	May 20, 1999	Chen
C20	Combined Downlink Beamforming and Channel Estimation for High Data Rate CDMA Systems, Proc. IEEE Signal Processing Workshop on Statistical Signal Processing (2001)	Sylvie Perreau	August 8, 2001	Perreau
C21	Adaptive Transmitting Antenna Methods for Multipath Environments, IEEE Globecom. Communications: The Global Bridge	Derek Gerlach, Arogyaswami Paulraj	December 2, 1994	Gerlach AT
C22	Adaptive Transmitting Antenna Arrays at the Base Station in Mobile Radio Networks	Derek Gerlach	August 1995	Gerlach Thesis

Exh.	Title	Author / Publisher	Date Published	Short Title
C23	Applications of Antenna Arrays to Mobile Communications, Part I – Performance Improvement, Feasibility, and System Consideration, 85 Proc. IEEE 1031 (1997)	Lai C. Godara	July 1997	Godara
C24	Downlink Beam-Forming Method Using STBC for Mobile Propagation Environments, IEEE Vehicular Tech. Conf. (2002)	Yasushi Takatori, Keizo Cho, Toshikazu Hori	May 9, 2002	Takatori
C25	Transmit Beamforming Power Control for Cellular Wireless Systems, 16 IEEE J. on Selected Areas in Comm'n 1437 (1998)	Farrokh Rashid Farrokhi, K. J. Ray Liu, Leandros Tassiulas	October 1998	Rashid Farrokhi
C28	An Overview of Smart Antenna Technology for Mobile Communications Systems, IEEE Communications Surveys, Fourth Quarter 1999, Vol. 2, No. 4	Per H. Lehne, Magne Pettersen	Fourth Quarter 1999	Lehne
C29	Digital Beamforming in Wireless Communications	John Litva, Titus Kwok Yeung Lo	August 31, 1996	Litva

d. The '511 Patent

The following references are discussed in the Obviousness section below, but are not separately charted in an exhibit.

Exh.	Title	Authors	Date Published	Short Title
	“An Overview of Smart Antenna Technology For Mobile Communications Systems”	Lehne	Lehne, et al., IEEE Communications Surveys, Fourth Quarter 1999, Vol. 2, No. 4,	Lehne

Exh.	Title	Authors	Date Published	Short Title
	"Wireless Communications"	Molisch	Andreas F. Molisch, published November 23, 2010 (2 nd edition), John Wiley & Sons, Ltd. (1 st edition published January 1, 2005)	Molisch
	Digital Beamforming in Wireless Communications	John Litva, Titus Kwok Yeung Lo	August 31, 1996	Litva
	3GPP TR 36.912 v. 9.3.0 (2010-06) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Feasibility study for Further Advancements for E-UTRA (LTE-Advanced) (Release 9)	3GPP	June 2010	3GPP
	3GPP TR 36.912 v. 2.0.0 (2009-08) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Feasibility study for Further Advancements for E-UTRA (LTE-Advanced) (Release 9)	3GPP	August 2009	3GPP
	"WiMAX RF MxFE Transceiver, AD9352-5," Data Sheet, Analog Devices, 2008.	Analog Devices	2008	AD9352-5
	"WiMAX RF MxFE Transceiver, AD9353," Data Sheet, Analog Devices, 2007.	Analog Devices	2007	AD9353

Exh.	Title	Authors	Date Published	Short Title
	"WiMAX/WiBro RF MxFE MISO Transceiver, AD9355," Data Sheet, Analog Devices, 2008-2009.	Analog Devices	2009	AD9355
	WiMAX/WiBro RF MxFE MISO Transceiver, AD9354," Data Sheet, Analog Devices, 2008-2009.	Analog Devices	2008-09	AD9354
	"WiMAX/BWA/WiBRO/LTE RF MxFE 2×2 MIMO Transceiver, AD9356," Data Sheet, Analog Devices, 2010.	Analog Devices	2010	AD9356
	"WiMAX/BWA/LTE RF MxFE 2×2 MIMO Transceiver, AD9357," Data Sheet, Analog Devices, 2010.	Analog Devices	2010	AD9357
	"WiMAX/WiBro RF MxFE Transceiver, AD9352," Data Sheet, Analog Devices, 2007.	Analog Devices	2007	AD9352
	Padhi, S. K. et al., "A Dual Polarized Aperture Coupled Circular Patch Antenna Using a C-Shaped Coupling Slot," IEEE Transactions on Antennas and Propagation, vol. 51, No. 12, Dec. 2003, pp. 3295-3298.	IEEE Transactions on Antennas and Propagation	December 2003	Padhi
	"DAN2400-PTP-Open SoC Platform for Sub-6GHz Wireless Point-to-Point Systems," DesignArt Networks, Jul. 2008, 2 pages.	Design Arts Networks	July 2008	DAN-2400

Each of these references is prior art under section 102(a). Furthermore, the following references are prior under section 102(b): Lehne, Molisch, Litva, 3GPP TR 36.912 v. 9.3.2; 3GPP TR 36.912 v. 2.0.0, Padhi, all of the Analog Devices data sheets, the DAN-2400 reference.

e. The '369 Patent

Exh.	Title	Date of Publication	Author/Publisher	Short Title
E03	“Multiuser OFDM with Adaptive Subcarrier, Bit and Power Allocation,”	October 1999	Wong, IEEE J. Select. Areas Commun., Vol. 17(10), pp. 1747-1758	Wong
E05	"An investigation into time-domain approach for OFDM channel estimation,"	December 2000	H. Minn and V. K. Bhargava, IEEE Transactions on Broadcasting, vol. 46, no. 4, pp. 240-248,	Minn
E06	“An Overview of Smart Antenna Technology For Mobile Communications Systems”	1999	Lehne, et al., IEEE Communications Surveys, Fourth Quarter 1999, Vol. 2, No. 4,	Lehne
E07	“Channel Estimation Using Pilot Tones in OFDM System”	December 1999	Yeh, et al., IEEE Transactions on Broadcasting, Vol. 45, No. 4, (pp. 400-409)	Yeh
E09	Digital Beamforming in Wireless Communications	August 31, 1996	John Litva, Titus Kwok Yeung Lo	Litva
E11	Adaptive Multicarrier Modulation: A Convenient Framework for Time-Frequency Processing in Wireless Communications	May 2000	Thomas Keller and Lajos Hanzo, IEEE Proceedings of the IEEE, Vol. 88, No. 5 (pp. 611-640)	Keller

3. Prior Art Systems

Defendants also contend that the Asserted Claims are invalid in view of public knowledge, uses and/or offers for sale or sales of products and services that are prior art under 35 U.S.C. § 102(a) and/or 35 U.S.C. § 102(b) and/or prior inventions made in this country by other inventors who had not abandoned, suppressed, or concealed them under 35 U.S.C. § 102(g), and that anticipate or render obvious the Asserted Claims.

The following lists each system that is now known by Defendants to constitute prior art under 35 U.S.C. §§ 102(a), (b) and/or (g). Defendants contend that the following descriptions and events are stated on information and belief, and are supported by the information and documents that will be produced by Defendants and/or third parties. As discovery is ongoing, Defendants continue to investigate these events.

Defendants also reserve the right to rely upon any system, public knowledge or use embodying or otherwise incorporating any of the prior art disclosed below, alone or in combination. Defendants further reserve the right to rely upon any other documents or references describing any such system, knowledge or use.

The following systems, and any other systems identified in these contentions, are prior art under one or more of 35 U.S.C. § 102(a), (b), and (g).

a. '235 Patent

In addition to the above patents and publications, the ArrayComm IntelliCell products are prior art based on their public sale and use by ArrayComm at least as early as 2000.

Defendants also identify prior art products, systems and/or printed publications that were generated as part of AT&T's "Project Angel." Project Angel related to AT&T's development (at least as early as 2000) of a multi-user fixed wireless system that provided high-speed Internet, voice telephone service, and home networking. AT&T's work on Project Angel led to public

testing no later than 1999 in Dallas, Texas, with around 2,000 customers participating in testing. AT&T also commercially implemented this system no later than March, 2000 in Fort Worth, Texas, where it offered fixed wireless Internet service for sale to customers. AT&T subsequently sold Project Angel in 2002 to Netro Corp., who was in turn acquired by SR Telecom Inc. in 2003. SR Telecom entered bankruptcy in 2007. Defendants have exercised reasonable diligence in trying to discover more information about Project Angel such that the related systems and printed publications could be identified with more detail in claim charts. Nevertheless, given the passage of time and the multiple companies involved, discovery is ongoing and Defendants reserve the right to supplement their contentions to include additional information that may become available.

Defendants also identify prior art products and systems that were generated as part of Navini Networks' broadband access equipment including at least Navini's Ripwave line of products. Navini Networks was founded in January 2000 and provided scalable, wireless broadband access network that required zero installation at the end-user site and offered non-line-of-sight operation, with the added benefit of nomadic/mobile capabilities. On information and belief, Navini's products incorporated adaptive antennas, transmitters, receivers, and beamforming (or spot forming) in order to create transmission peaks and nulls. Navini Networks was based in Plano, TX and had over 70 worldwide deployments of its products. Defendants have exercised reasonable diligence in trying to discover more information about Navini Network's products during the relevant, early 2000 timeframe such that the related systems and printed publications could be identified with more detail in claim charts. Nevertheless, given the passage of time and the multiple companies involved, discovery is ongoing and Defendants reserve the right to supplement their contentions to include additional information that may become available.

Furthermore, based on information currently known to Defendants, products or systems from at least the following companies may also constitute prior art based on their public sale and use prior to the claimed priority date of the '235 Patent: Iospan Wireless (a.k.a. Gigabit Wireless); Motia, Inc.; Clarity Wireless, Corp.; Cognio, Inc.; Motorola, Inc.; Motorola Solutions, Inc.; Motorola Mobility, LLC; Lenovo Group Limited; Google, Inc.; Toshiba Corp.; Kabushiki Kaisha Toshiba, Japan; and Metawave Corp. Defendants' investigation, including third-party discovery in this matter, is ongoing.

b. '939 Patent

In addition to the above patents and publications, the ArrayComm IntelliCell products are prior art based on their public sale and use by ArrayComm at least as early as 2000. Additionally, the ORiNOCO AP-1000 (Exhibit B-18) products are prior art based on their public sale and use by Lucent Technologies at least as early as 2000. Additionally the "Project Angel" system (Exhibit B-28) is prior art based on its public sale and use by AT&T at least as early as 1999. Project Angel related to AT&T's development (at least as early as 2000) of a multi-user fixed wireless system that provided high-speed Internet, voice telephone service, and home networking. AT&T's work on Project Angel led to public testing no later than 1999 in Dallas, Texas, with around 2,000 customers participating in testing. AT&T also commercially implemented this system no later than March, 2000 in Fort Worth, Texas, where it offered fixed wireless Internet service for sale to customers. AT&T subsequently sold Project Angel in 2002 to Netro Corp., who was in turn acquired by SR Telecom Inc. in 2003. SR Telecom entered bankruptcy in 2007. Defendants have exercised reasonable diligence in trying to discover more information about Project Angel such that the related systems and printed publications could be identified with more detail in claim charts. Nevertheless, given the passage of time and the multiple companies involved, discovery is

ongoing and Defendants reserve the right to supplement their contentions to include additional information that may become available.

Furthermore, based on information currently known to Defendants, products or systems from at least the following companies may also constitute prior art based on their public sale and use prior to the claimed priority date of the '939 Patent: Iospan Wireless; Navini Networks, Inc.; Colubris Networks, Inc.; Motia, Inc.; Clarity Wireless, Corp.; Cognio, Inc.; Motorola, Inc.; Motorola Solutions, Inc.; Motorola Mobility, LLC; Lenovo Group Limited; Toshiba Corp.; Kabushiki Kaisha Toshiba, Japan; AT&T Corp.; Lucent Technologies; Intel Corporation; Qualcomm Incorporated; Telefonaktiebolaget LM Ericsson; Nokia Corporation; Sharp Laboratories of America, Inc.; 3COM Corporation; Broadcom Corporation; Agere Systems, Inc; and Metawave Corp. Defendants' investigation, including third-party discovery in this matter, is ongoing.

All of the above references and products/systems qualify as prior art to the '939 patent. The references listed above are prior art under at least 35 U.S.C. § 102(a), (b), (e), and/or (g) based on their filing dates, issue dates, and/or publication dates, as further detailed in the charts attached hereto.

c. '376 Patent

In addition to the above patents and publications, the ArrayComm IntelliCell products are prior art based on their public sale and use by ArrayComm at least as early as 2000.

Defendants also identify prior art products, systems and/or printed publications that were generated as part of AT&T's "Project Angel." Project Angel related to AT&T's development (at least as early as 2000) of a multi-user fixed wireless system that provided high-speed Internet, voice telephone service, and home networking. AT&T's work on Project Angel led to public testing no later than 1999 in Dallas, Texas, with around 2,000 customers participating in testing.

AT&T also commercially implemented this system no later than March, 2000 in Fort Worth, Texas, where it offered fixed wireless Internet service for sale to customers. AT&T subsequently sold Project Angel in 2002 to Netro Corp., who was in turn acquired by SR Telecom Inc. in 2003. SR Telecom entered bankruptcy in 2007. Defendants have exercised reasonable diligence in trying to discover more information about Project Angel such that the related systems and printed publications could be identified with more detail in claim charts. Nevertheless, given the passage of time and the multiple companies involved, discovery is ongoing and Defendants reserve the right to supplement their contentions to include additional information that may become available.

Defendants also identify prior art products and systems that were generated as part of Navini Networks' broadband access equipment including at least Navini's Ripwave line of products. Navini Networks was founded in January 2000 and provided scalable, wireless broadband access network that required zero installation at the end-user site and offered non-line-of-sight operation, with the added benefit of nomadic/mobile capabilities. On information and belief, Navini's products incorporated adaptive antennas, transmitters, receivers, and beamforming (or spot forming) in order to create transmission peaks and nulls. Navini Networks was based in Plano, TX and had over 70 worldwide deployments of its products. Defendants have exercised reasonable diligence in trying to discover more information about Navini Network's products during the relevant, early 2000 timeframe such that the related systems and printed publications could be identified with more detail in claim charts. Nevertheless, given the passage of time and the multiple companies involved, discovery is ongoing and Defendants reserve the right to supplement their contentions to include additional information that may become available.

Furthermore, based on information currently known to Defendants, products or systems from at least the following companies may also constitute prior art based on their public sale and

use prior to the claimed priority date of the '376 Patent: Iospan Wireless (a.k.a. Gigabit Wireless); Motia, Inc.; Clarity Wireless, Corp.; Cognio, Inc.; Motorola, Inc.; Motorola Solutions, Inc.; Motorola Mobility, LLC; Lenovo Group Limited; Google, Inc.; Toshiba Corp.; Kabushiki Kaisha Toshiba, Japan; and Metawave Corp. Defendants' investigation, including third-party discovery in this matter, is ongoing.

d. '511 Patent

Based on information currently known to Defendants, products or systems from at least the following companies may also constitute prior art based on their public sale and use prior to the claimed priority date of the '511 Patent: Fastback Networks (which corresponds to the Negus reference as charted in D07); Tarana Wireless, Inc. (which corresponds to the Branlund reference as charted in D06); and DesignArt Networks (which corresponds to the Barak reference as charted in D05). Defendants intend to adduce further evidence on the availability and operation of these products during discovery.

In addition, to the extent they are considered "systems," the Negus reference charted in D07 included specific citation to numerous existing commercial products and submitted the datasheets and other materials to the PTO during the prosecution for those commercial products. Defendants intend to rely upon the operation of those products as a "system" as appropriate. Those products are also identified in the non-patent publications section above.

In addition, with respect to the Fastback Networks product, the operation of that product is shown in further patents including USP 8,385,305; USP 8,649,418; USP 8,989,762; USP 8,502,733; USP 8,422,540; USP 8,761,100. Defendants intend to rely upon the disclosures of those patents to establish the operation of the Fastback Networks product(s). Dr. Kevin J. Negus can provide details regarding the operation of the Fastback Networks products.

e. **'369 Patent**

In addition to the above patents and publications, the ArrayComm IntelliCell products are prior art based on their public sale and use by ArrayComm at least as early as 2000. Additionally, the “Project Angel” system (Exhibit E-10) is prior art based on its public sale and use by AT&T at least as early as 1999. Project Angel related to AT&T’s development (at least as early as 2000) of a multi-user fixed wireless system that provided high-speed Internet, voice telephone service, and home networking. AT&T’s work on Project Angel led to public testing no later than 1999 in Dallas, Texas, with around 2,000 customers participating in testing. AT&T also commercially implemented this system no later than March, 2000 in Fort Worth, Texas, where it offered fixed wireless Internet service for sale to customers. AT&T subsequently sold Project Angel in 2002 to Netro Corp., who was in turn acquired by SR Telecom Inc. in 2003. SR Telecom entered bankruptcy in 2007. Defendants have exercised reasonable diligence in trying to discover more information about Project Angel such that the related systems and printed publications could be identified with more detail in claim charts. Nevertheless, given the passage of time and the multiple companies involved, discovery is ongoing and Defendants reserve the right to supplement their contentions to include additional information that may become available.

B. P.R. 3-3(b) Disclosures: Each Item of Prior Art that Anticipates and/or Renders Obvious the Asserted Claim, and Obviousness Combinations and Motivations to Combine

Based on presently known information and the apparent constructions XR is asserting in its Infringement Contentions, the prior art references identified above anticipate the Asserted Claims or, alone or in combination with the knowledge in the art, render the Asserted Claims obvious. To the extent XR asserts that any of the prior art references charted in Exhibits A-01 et seq., B-01 et seq., C-01 et seq., D-01 et seq., and E-01 et seq., fail to explicitly or inherently disclose any element of the Asserted Claims, Defendants contend that it would have been obvious

to modify such reference to include the allegedly missing element, in view of the knowledge of one of ordinary skill in the art, the admitted prior art of the Asserted Patents, and/or in combination with any of the other prior art references identified in the Exhibits for that respective patent. To the extent XR contends that any primary reference does not anticipate the Asserted Claims, it would have been obvious to combine or modify the primary references with concepts from other prior art.

In particular, for each limitation of the Asserted Claims that XR contends is not met by a particular primary reference, Defendants contend that the limitation (and claim as a whole) is obvious based on a combination of that particular primary reference with (1) any other primary reference disclosing that limitation, (2) any other reference as identified in Exhibits A–E as disclosing that limitation, (3) any admitted prior art, as explained in the background of each patent or discussed in the file history, and/or (4) the knowledge of a person of ordinary skill in the art including any of the references and concepts discussed herein regarding the relevant background and state of the art. The specific combinations of prior art that Defendants contend render the Asserted Claims obvious are readily determinable as described herein and as provided in Exhibits A–E. Defendants’ obviousness grounds for each dependent claim incorporate the obviousness grounds for the claim(s) from which the dependent claim depends in addition to any obviousness grounds identified in the charts for the dependent claim.

Defendants do not yet have the benefit of XR’s positions on the prior art, including what (if any) elements it contends are missing in each prior art reference, whether XR agrees that a reference is in fact prior art, and whether XR agrees that a person of ordinary skill in the art would be motivated to combine specific references. Defendants reserve the right to supplement these

obviousness positions (including identifying additional prior art combinations and the associated reasons to combine) as discovery in the case progresses, including expert discovery.

While the categories of art (patents/applications, non-patent publications, and systems) below are organized by asserted patent number, because of the overlapping nature of the asserted patents, Defendants identify each reference in each category as art applicable to each of the asserted patents.

1. Background and State of the Art

Defendants set forth below a summary of their current understanding of the state of the art as understood as of the asserted priority dates of the Asserted Patents for the general subject matter of each of the Asserted Patents. The information discussed in this section may have formed the background knowledge of a person of ordinary skill in the art at the time the Asserted Patents were filed and may have been used in determining whether and how to combine references to achieve the claimed inventions. *See Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013) (stating that “the knowledge [of a person of ordinary skill in the art] is part of the store of public knowledge that must be consulted when considering whether a claimed invention would have been obvious”). Defendants expressly reserve the right to rely on each of the prior art references, systems, concepts, and technologies discussed in this Section with respect to each of the Asserted Patents. In addition to the prior art identified in Section II.A, Defendants reserve the right to rely on each of the prior art references in its prior art document production. Further, Defendants identify the following prior art references that provide information concerning the state of the art at or before the priority date of the Asserted Claims.

a. '235 Patent

Patent No. / Publication

Prior art listed in the file history of the '235 Patents, or that of any related foreign or domestic patent applications
HOMERF
GSM
IS-95
WCDMA
CDMA2000
IEEE 802.11-1999
IEEE 802.11a-1999
IEEE 802.11b-1999
IEEE 802.11f-2003
IEEE 802.11g-2003
IEEE 802.11h-2003
Smart Antennas for Dummies (Author: Arild Jacobsen, ISBN: 82-423-0388-6)
Gerard. J. Foschini (October 1996), "Layered Space-Time Architecture for Wireless Communication in a Fading Environment When Using Multi-Element Antennas," Bell Laboratories Technical Journal: 41–59.
P. W. Wolniansky; G. J. Foschini; G. D. Golden; R. A. Valenzuela (September 1998), "V-BLAST: An Architecture for Realizing Very High Data Rates Over the Rich-Scattering Wireless Channel," Proc. URSI ISSSE: 295–300.
U.S. 4,750,147
U.S. 4,965,732
U.S. 5,515,378
U.S. 5,546,090
US 5,642,353
U.S. 5,553,074
U.S. 5,697,066
U.S. 5,739,788
U.S. 5,886,988
U.S. 5,890,067
U.S. 6,006,110
U.S. 6,067,290
U.S. 6,101,399
U.S. 6,219,561
U.S. 6,330,460
U.S. 6,351,499
U.S. 6,564,036
U.S. 6,665,545
U.S. 6,687,492
U.S. 6,795,409
U.S. 7,130,662

U.S. 7,212,499
U.S. 6,301,238
U.S. 6,621,454
WO00/072464
WO01/010156
WO03/075396
WO97/00543
WO97/33388
WO98/18271
“Adaptive Transmitting antenna arrays at the Base Station in Mobile Radio Networks,” Derek Gerlach
A.S. Acampora, S.V. Krishnamurthy, and M. Zorzi, “Media Access Protocols for Use with Smart Adaptive Array Antennas to Enable Wireless Multimedia Communications” Wireless Networks, Springer-Verlag, 1998.
Z.-S. Zhang and A.S. Acampora, “Performance of a Modified Polling Strategy for Broadband Wireless Access in a Harsh Fading Environment,” Telecommunication Systems, Vol. 1, No. 3, 1993.
A. Acampora and S Krishnamurthy, “A New Adaptive MAC Protocol for Broadband Packet Networks in Harsh Fading and Interference Environments”, IEEE/ACM Transactions on Networking, Vol. 8, No. 3, June 2000.
S.V. Krishnamurthy, A.S. Acampora, and M. Zorzi, “Polling-Based Media Access Protocols for Use with Smart Adaptive Array Antennas,” IEEE/ACM Trans. Networking Vol. 9, No. 2, April 2001.
Z. Zhang and A.S. Acampora, “Performance of a Modified Polling Strategy for Broadband Wireless LANs in a Harsh Fading Environment,” IEEE GLOBECOM '91 Conference Record, Dec. 1991, Phoenix.
S. Krishnamurthy, A. S. Acampora, and M. Zorzi, “Polling Based Media Access Protocols for Use With Smart Adaptive Array Antennas”, Conference Record, International Conference on Universal Personal Communications, Florence, Oct., 1998.
A. S. Acampora and S. V. Krishnamurthy, “A New Adaptive MAC Layer Protocol for Wireless ATM Networks in Harsh Fading and Interference Environments,” IEEE Intl. Conf. Universal Personal Comm., San Diego, Oct. 1997.
A.S. Acampora and J.H. Winters, “A Wireless Network for Wide-Band Indoor Communications,” JSAC, Vol. 5, No. 5, 1987.
A.S. Acampora and J.H. Winters, “System Applications for wireless Indoor Communications,” IEEE Communications Magazine, Vol. 25, No. 8, 1987.
Yamaguchi et al., “4 GHz 8x8 Switch Matrix for SDMA System,” Microwave Symposium, 1975 IEEE-MTT-S International.
Gerlach et al., “Spectrum Reuse Using Transmitting Antenna Arrays with Feedback,” Acoustics, Speech, and Signal Processing, ICASSP, 1994.
S. Krishnamurthy, A. S. Acampora, and M. Zorzi, “Polling Based Media Access Protocols for Use With Smart Adaptive Array Antennas”, Conference Record, International Conference on Universal Personal Communications, Florence, Oct., 1998.

A. S. Acampora and S. V. Krishnamurthy, "A New Adaptive MAC Layer Protocol for Wireless ATM Networks in Harsh Fading and Interference Environments," IEEE Intl. Conf. Universal Personal Comm., San Diego, Oct. 1997.
Gerlach et al., "Adaptive Transmitting Antenna Arrays with Feedback," IEEE Signal Processing Letters, Oct. 1994.
Gerlach et al., "Base Station Transmitting Antenna Arrays for Multipath Environments," Signal Processing, Oct. 1996.
Foschini et al., "On Limits of Wireless Communications in a Fading Environment when Using Multiple Antennas," <i>Wireless Personal Communications</i> , 1998.
A. J. Paulraj and C. B. Papdias, "Space-Time Processing for Wireless Communications," IEEE Signal Processing Magazine, pp. 49-83, November 1997.
U.S. 7,529,305
S. Anderson et al., "An Adaptive Array for Mobile Communication Systems," IEEE Transactions on Vehicular Technology, Vol. 40, No. 1, February 1991.
G. Foschini et al., "BLAST Bell Labs Layered Space Time", Bell Labs.
L.H. Brandenburg and A.D. Wyner, "Capacity of the Gaussian Channel with Memory, The Multivariate Case", The Bell System Technical Journal, Vol. 53, Issue 5, May-June 1974.
D. Chapman, "First-Hand: Sidelobe Cancellers and the Like", IEEE,
A.J. Fenn, et al., "The Development of Phased-Array Radar Technology", Lincoln Laboratory Journal Vol. 12, Number 2.
G.J. Foschini, "Layered Space-Time Architecture for Wireless Communication in a Fading Environment when Using Multi-Element Antennas", Bell Labs Technical Journal.
A.R. Kaye, "Transmission of Multiplexed PAM Signals Over Multiple Channel and Diversity Systems", IEEE Transaction on Communications, Vol. 18, No. 5.
G. Raleigh, et al., "Characterization of Fast Fading Vector Channels for Multi-Antenna Communication Systems", IEEE.
G.G. Raleigh, et al., "Spatio-Temporal Coding for Wireless Communications", IEEE Transactions on Communications, Vol. 46, No. 3.
D.O. Reudink, et al., "A Scanning Spot-Beam Satellite System", The Bell System Technical Journal.
S.C. Swales, et al., "Multi-Beam Adaptive Base-Station Antennas for Cellular Land Mobile Radio Systems", IEEE.
W. Van Etten, "Maximum Likelihood Receiver for Multiple Channel Transmission Systems", IEEE Transactions on Communications.
J.H. Winters, "Optimum Combining in Digital Mobile Radio with Cochannel Interference", IEEE Journal on Selected Areas in Communications, Vol. SAC-2, No. 4.
U.S. 5,345,599, A.J. Paulraj, et al., "Increasing capacity in wireless broadcast systems using distributed transmission/directional reception (DTDR)", Sept. 6, 1994.
U.S. 5,515,378, R.H. Roy III and Bjorn Ottersen, "Spatial Division Multiple Access Wireless Communication Systems", May 7, 1996.
U.S. 5,642,353, R.H. Roy III, et al., "Spatial Division Multiple Access Wireless Communication Systems", June 24, 1997.
M. Cooper, "A Layman's Guide to Cellular", Annual Review of Communications.
R.H. Roy, "Application of Smart Antenna Technology in Wireless Communication Systems".

B. Ottersten, "Array Processing for Wireless Communications".
M. Cooper, et al., "Intelligent Antennas: Spatial Division Multiple Access", Intelligent Antennas: Spatial Division Multiple Access, 1996 Annual Review of Communications.
"Intellicell: A Fully Adaptive Approach to Smart Antennas" ArrayComm, Inc., 2002
Commercial Deployment of Adaptive Antennas, Spectrum Management 2003, May 20-21, 2003
D. Nowicki, et al., "Smart Antenna Strategies", Mobile Communication International, April 1995.
M. Goldburg, et al., "The Impacts of SDMA on PCS System Design", IEEE.
J. Kang, et al., "Low Complexity Array Response Vector Estimation For Smart Antenna Systems", 2000 IEEE.
H. Li, et al., "Coded Beamforming for Block Fading Vector Channel", Dept. of Electrical and Computer Engineering, 2001, IEEE.
K.R. Dandekar, et al., "Effect of mutual coupling on direction finding in smart antenna applications", Electronics Letters, Oct. 26, 2000, Vol. 36, No. 22.
L. Bigler, et al., "Experimental Direction of Arrival and Spatial Signature Measurements at 900 MHz for Smart Antenna Systems", 1995 IEEE.
S-S. Jeng, et al., "Experimental Evaluation of Smart Antenna System Performance for Capacity Improvement", 1997 IEEE.
S-S. Jeng, et al., "Experimental Evaluation of Smart Antenna System Performance for Wireless Communications", IEEE Transactions on Antennas and Propagation, Vol., 46, No. 6, June 1998.
S-S Jeng, et al., "Experimental Studies of Spatial Signature Variation at 900 MHz for Smart Antenna Systems", 1998 IEEE.
K.R. Dandekar, et al., "Modeling And Prediction Of The Wireless Vector Channel Encountered By Smart Antenna Systems", Microwave And Optical Technology Letters, Vol. 35, No. 4, November 20, 2002.
S..C. Swales, et al., "Multi-Beam Adaptive Base-Station Antennas For Cellular Land Mobile Radio Systems", 1989 IEEE.
W. Yang, et al., "New Method for Designing Smart Antenna Downlink Weighting Vectors Based on the Filter Bank Concept", SPIE, Vol, 3162.
P. Balaban, et al., "Optimum diversity Combining and Equalization in Digital Data Transmission with Applications to Cellular Mobile Radio - Part I: Theoretical Considerations", 1992 IEEE.
J.A. Cadzow, et al., "Resolution Of Coherent Signals Using A Linear Array", 1987 IEEE.
G. Xu, et al., "Smart Antenna systems for Wireless Communications", 1988 IEEE.
J.H. Winters, et al., "The Impact of Antenna Diversity on the Capacity of Wireless Communication Systems", IEEE Transactions on Communications, Vol. 42, No. 2/3/4, February/March/April 1994.
H. Li, et al., "Transmission Optimization Over Flat Rayleigh Fading channel with Multiple Antennas", 1999 IEEE.
A. Kavak, et al., "Vector Channels for Smart Antennas - Measurements, Statistical Modeling, and Directional Properties in Outdoor Environments", IEEE Transactions On Microwave Theory And Techniques, Vol, 48, No. 6, June 2000.

A.F. Naguib, et al., "Performance Of CDMA Cellular Networks With Base-Station Antenna Arrays: The Downlink", 1994 IEEE.
U.S. 5,914,946, D. Avidor, et al., "TDM-Based Fixed Wireless Loop System", Jun. 22, 1999.
US 5,687,194 E. Paneth, et al., "Subscriber RF Telephone System For Providing Multiple Speech And/Or Data Signals Simultaneously Over Either A Single Or A Plurality Of RF Channels".
U.S. 5,828,658, B.E. Ottersten, et al., "Spectrally Efficient High Capacity Wireless Communication Systems With Spatio-Temporal Processing", Oct. 27, 1998.
J. Liang & A. Paulraj, "Forward link antenna diversity using feedback for indoor communication systems", IEEE, 1995 International Conference on Acoustics, Speech, and Signal Processing, Vol. 3, pp. 1753-5
D. Gerlach & A. Paulraj, "Base station transmitter antenna arrays with mobile to base feedback", IEEE, Proceedings of 27th Asilomar Conference on Signals, Systems and Computers, Vol. 2, pp. 1432-6
A. Naguib, A. Paulraj, & T. Kailath, "Capacity improvement of base-station antenna arrays cellular CDMA", IEEE, Proceedings of 27th Asilomar Conference on Signals, Systems and Computers, Vol. 2, pp. 1437-41
G. Raleigh & V. K. Jones, "Adaptive Antenna Transmission for Frequency Duplex Digital Wireless Communication", IEEE, 1997 IEEE International Conference on Communications, Vol. 2, pp. 641-6
P. Lehne & M. Petterson, "An overview of smart antenna technology for mobile communications systems", IEEE Communications Surveys, Fourth Quarter 1999, Vol. 2, No. 4
A. Paulraj, "Smart antennas for battlefield multimedia wireless networks with dual use applications" (August 1998)
D. Gerlach, "Adaptive Transmitting antenna arrays at the Base Station in Mobile Radio Networks" (August 1995)
Yee, Limmartz, & Fettweis, "Multicarrier CDMA in indoor wireless radio networks", Proc. PMIRC '93, Yokohoma, Japan, pp. 109-113, September 1993
"Essentials of ATM Networks," Oliver C. Ibe, Addison-Wesley 1997
"Computer Networks", Andrew S. Tanenbaum, 3d Ed. Prentice Hall PTR 1996
T.E. Curtis, "Digital Beamforming for Sonar System," IEEE Proc. Pt. F, Vol. 127 pp. 257-265, Aug. 1980
P. Barton, "Digital Beamforming for radar", I IEEE Proc. Pt. F., Vol. 266-267, Aug. 1980
S. Applebaum, "Adaptive Arrays," IEEE Trans. On Antennas and Propagation, Vo. AP-24, No. 5, pp. 585-598, Sep. 1976
R. T. Compton, Jr., <i>Adaptive Antennas: Concepts and Applications</i> , Prentice Hall, Englewood Cliffs, NJ, 1988
J.E. Hudson, <i>Adaptive Array Principles</i> , Peregrinus, London 1981
R. A. Monzingo & T.W. Miller, <i>Introduction to Adaptive Arrays</i> , John Wiley & Sons, 1980
W.F. Gabriel, "Adaptive Arrays – an introduction," Proc. IEEE, vol 64, pp. 239-272, Feb. 1976
B.D. Van Veen & K.M. Buckley, "Beamforming: A versatile approach to spatial filtering," IEEE ASSP Magazine, vol. 5, pp. 4-24, Apr. 1998

B. Widrow, P. E. Mantey, L. J. Griffiths, and B.B. Goode, "Adaptive Antenna Systems," Proc. IEEE, vol. 55, pp. 2143-2159, Dec. 1967
R. T. Compton, R. J. Huff, W.G. Swarner, and A. A. Ksienki, "Adaptive Arrays for Communication Systems: An overview of research at the Ohio State University", IEEE Trans. Antennas Propagation, vol. AP-24, pp. 599-607, 1976
B.G. Agee, S.V. Schell, and W. A. Gardner, "Spectral Self-Coherence Restoral: A New Approach to Blind Adaptive Signal Extraction Using Antenna Arrays," Proc. IEEE, vo. 78, pp. 753-767, Apr. 1990
Q. Wu, K.M Wong, and R. Ho, "A fast algorithm for adaptive beamforming of cyclic signals," IEEE Proc. Pt. F, vo.. 141, pp. 312-318, Dec. 1994
J. H. Winters, "Increased Data Rate for Communication Systems with Adaptive Antennas," Proc. IEEE Int. Conf. Comm., June 1982
Y.S. Yeh and D. O. Reudink, "Efficient Spectrum Utilization for Mobile Radio Systems Using Space Diversity," IEEE Int. Conf. Radio Spectrum Conservation Techniques, London, pp. 12-16, 1980
Y. S. Yeh and D. O. Reudink, "Efficient Spectrum Utilization for Mobile Radio Systems Using Space Diversity," IEEE Trans. Comm. Vo. COM-30, pp. 447-455, March 1982
J. H. Winters, "Optimum combining in digital mobile radio with co-channel interference," IEEE Trans. Veh. Technol., vol 33. Pp. 144-155, Aug. 1984
U.S. Patent No. 7,200,368
U.S. Patent No. 7,079,514
U.S. Patent No. 6,232,921
U.S. Patent No. 6,219,561
U.S. Patent No. 6,108,565
U.S. Patent No. 6,901,062
U.S. Patent No. 7,139,324
U.S. Patent No. 7,054,662
U.S. Patent No. 7,499,499
U.S. Patent No. 7,447,270
U.S. Patent No. 6,347,234
U.S. Patent No. 6,980,832
U.S. Patent No. 6,501,747
U.S. Patent No. 7,050,480
U.S. Patent No. 7,039,441
U.S. Patent No. 5,815,116
U.S. Patent No. 6,188,913
U.S. Patent No. 6,496,535
U.S. Patent No. 6,834,076
U.S. Patent No. 7,088,782
U.S. Patent No. 7,310,304
U.S. Patent No. 7,706,458
U.S. Patent Publication No. 2002/0086708

U.S. Patent Publication No. 2003/0017853
U.S. Patent No. 6,553,012
U.S. Patent No. 6,970,722
U.S. Patent No. 7,042,394
U.S. Patent Publication No. 2003/0060205
U.S. Patent No. 6,738,020
U.S. Patent No. 6,795,409
U.S. Patent No. 7,529,525
L. Chen et al., "A Dynamic Channel Assignment Algorithm for Cellular System with Adaptive Array Antennas," IEEE Veh. Tech. Conf. 2001.
S. Perreau, "Combined Downlink Beamforming and Channel Estimation for High Data Rate CDMA Systems," Proc. IEEE Signal Processing Workshop on Statistical Signal Processing (2001)
F. Rashid Farrokhi et al, "Transmit Beamforming Power Control for Cellular Wireless Systems," 16 IEEE J. on Selected Areas in Comm'n 1437 (1998)
S. Choi et al., "Transmitter Power Control (TPC) and Dynamic Frequency Selection (DFS) Joint Proposal for 802.11h WLAN," IEEE 802.11-01/169r2
M. Ghosh et al, "On the Use of Multiple Antennae for 802.11," IEEE 802.11-02/180r0
H. Yu, "HDR 802.11a Solution Using MIMO-OFDM," IEEE 802.11-02/294r1
J. Regnier, "Benefits of Smart Antennas in 802.11 Networks," IEEE 802.11-03/025r0
A. van Zelst et al., "Space Division Multiplexing (SDM) for OFDM Systems," 51 IEEE Veh. Tech. Conf., Vol. 2, pp. 1070-1074 (Spring 2000)
A. Hori et al, "System Capacity and Cell Radius Comparison with Several High Data Rate WLANs" IEEE 802.11-02/159r1
P. Brenner, "A Technical Tutorial on the IEEE 802.11 Protocol," Breezcom Wireless Communications (July 18, 1996)
Siemens AG & Technical University of Munich, "Advanced closed loop Tx diversity concept (eigenbeamformer)," 3GPP TSGR1#14(00)0853, July 2000
H. Holma & A. Toskala, "WCDMA for UMTS," John Wiley & Sons, 2000

b. '939 Patent

Patent No. / Publication
Prior art listed in the file history of the '939 Patent, or that of any related foreign or domestic patent applications
Donald Cox & Douglas Reudink, Dynamic Channel Assignment in High-Capacity Mobile Communications Systems, 50 Bell Sys. Tech. J. 1833 (1971)
Donald Cox & Douglas Reudink, A Comparison of Some Channel Assignment Strategies in Large-Scale Mobile Communications Systems, 20 IEEE Transactions Commc'ns 190 (1972)
Donald Cox & Douglas Reudink, Dynamic Channel Assignment in Two-Dimensional Large-Scale Mobile Radio Systems, 51 Bell Sys. Tech. J. 1611 (1972)

Donald Cox & Douglas Reudink, Increasing Channel Occupancy in Large-Scale Mobile Radio Systems: Dynamic Channel Reassignment, 21 IEEE Transactions Commc'ns 1302 (1973)
Harald Haas, Interference Analysis of and Dynamic Channel Assignment Algorithms in TD-CDMA/TDD Systems (2001)
Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; Data Link Control (DLC) Layer; Part 1: Basic Data Transport Functions, ETSI TS 101 761-1 V1.2.1 (2000-11)
Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; Data Link Control (DLC) Layer; Part 2: Radio Link Control (RLC) sublayer, ETSI TS 101 761-2 V1.2.1 (2001-04)
Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; Physical (PHY) layer, ETSI TS 101 475 V1.2.2 (2001-02)
Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; System Overview, ETSI TR 101 683 V1.1.1 (2000-02)
Harri Holma et al. Interference Considerations for the Time Division Duplex Mode of the UMTS Terrestrial Radio Access, 18 IEEE J. Selected Areas Commc'ns 1386 (2000)
IEEE P802.11 Wireless LANs Proposed DFS Test (Mar. 2002), IEEE 802.11-02/154r0
IEEE P802.11 Wireless LANs, IEEE802.11h, A Proposal for Dynamic Frequency Selection (DFS), IEEE 802.11-02/161r0 (Feb. 15, 2002)
IEEE P802.11 Wireless LANs, TPC/DFS Proposal for 802.11h, IEEE 802.11-01/217 (Apr. 13, 2001)
Hua Jiang & Stephen S. Rappaport, CBWL for Sectorized Cellular Communications, CEAS Tech. Rep. No. 654 (1993)
Hua Jiang & Stephen S. Rappaport, A Channel Borrowing Scheme for TDMA Cellular Communication Systems, 1 IEEE 45th VTC 97 (1995)
Scott Jordan, Resource Allocation in Wireless Networks, 5 J. High Speed Networks 23 (1996)
Gordon J.R. Povey, Investigation of Multiple Access Interference Within UTRA-TDD, IEEE 10th European Signal Processing Conference (2000)
Miao Qingyu et al., An Investigation of Inter-Cell Interference in UTRA-TDD System, 6 IEEE VTS Fall VTC 3002 (2000)
Theodore S. Rappaport, Wireless Communications Principles and Practice (1st & 2d eds. 1996 & 2002)
Isabelle Tardy et al., Interference in TDD Based LMDS Systems, IST Mobile and Wireless Summit (2002)
Universal Mobile Telecommunications System (UMTS); UMTS Terrestrial Radio Access (UTRA); Concept Evaluation (UMTS 30.06 version 3.0.0), TR 101 146 v3.0.0 (1997-12)
Li-Chun Wang et al., Architecture Design, Frequency Planning, and Performance Analysis for a Microcell/Macrocell Overlaying System, 46 IEEE Transactions Vehicular Tech. 836 (1997)
U.S. 5,722,043
U.S. 6,985,465
U.S. 7,206,840
U.S. 6,859,450
U.S. 5,907,544
U.S. Patent Publication No. 2004/0037258
I. Katzela et al, "Channel Assignment Schemes for Cellular Mobile Telecommunications Systems: A Comprehensive Survey," IEEE Personal Communications 10 (1996)

IEEE 802.11-1999
IEEE 802.11a-1999
IEEE 802.11b-1999
IEEE 802.11f-2003
IEEE 802.11g-2003
S. Choi et al., "Transmitter Power Control (TPC) and Dynamic Frequency Selection (DFS) Joint Proposal for 802.11h WLAN," IEEE 802.11-01/169r2
M. Ghosh et al, "On the Use of Multiple Antennae for 802.11," IEEE 802.11-02/180r0
H. Yu, "HDR 802.11a Solution Using MIMO-OFDM," IEEE 802.11-02/294r1
J. Regnier, "Benefits of Smart Antennas in 802.11 Networks," IEEE 802.11-03/025r0
A. van Zelst et al., "Space Division Multiplexing (SDM) for OFDM Systems," 51 IEEE Veh. Tech. Conf., Vol. 2, pp. 1070-1074 (Spring 2000)
A. Hori et al, "System Capacity and Cell Radius Comparison with Several High Data Rate WLANs" IEEE 802.11-02/159r1
P. Brenner, "A Technical Tutorial on the IEEE 802.11 Protocol," Breezcom Wireless Communications (July 18, 1996)
Siemens AG & Technical University of Munich, "Advanced closed loop Tx diversity concept (eigenbeamformer)," 3GPP TSGR1#14(00)0853, July 2000
H. Holma & A. Toskala, "WCDMA for UMTS," John Wiley & Sons, 2000
Litva, et al, "Digital Beamforming in Wireless Communications", Artech House Publishers, Publication date: August 31, 1996 ISBN 10: 0890067120 / ISBN 13: 9780890067123
Joseph C. Liberti et al, "Smart Antennas for Wireless Communications: Third Generation Cdma Applications," Publication date: January 1, 1999, ISBN-10: 0137192878, ISBN-13: 978-0137192878
Pieter van Rooyen et al., "Space-Time Processing for CDMA Mobile Communications," Publication date: February 29, 2000, ISBN-10: 9780792377597, ISBN:13: 978-0792377597
Da-Shan Shiu, "Wireless Communication Using Dual Antenna Arrays," Publication date: November 30, 1999, ISBN-10: 0792386809, ISBN-13: 978-0792386803
U.S. Patent No. 7,594,010
U.S. Patent No. 4,610,010
U.S. Patent No. 5,208,812
U.S. Patent No. 6,538,375
U.S. Patent Publication No. 2002/0120740
U.S. Patent No. 6,370,356
U.S. Patent No. 6,711,420
U.S. Patent No. 7,415,083
U.S. Patent No. 7,573,945
U.S. Patent No. 7,912,014
U.S. Patent Publication No. 2003/0138029
U.S. Patent No. 8,422,587
U.S. Patent Publication No. 2003/0188006
U.S. Patent Publication No. 2003/0198281

U.S. Patent Publication No. 2004/0157551
U.S. Patent Publication No. 2004/0185801
U.S. Patent No. 5,488,750
U.S. Patent No. 5,963,865
U.S. Patent No. 7,130,635
U.S. Patent No. 5,956,642
U.S. Patent No. 5,898,928
U.S. Patent No. 6,240,275
U.S. Patent No. 6,351,643
U.S. Patent No. 6,788,656
U.S. Patent No. 5,329,575
U.S. Patent No. 5,787,346
U.S. Patent No. 7,079,822
U.S. Patent No. 6,813,253
U.S. Patent No. 6,799,044
U.S. Patent No. 7,072,663
U.S. Patent No. 7,424,299
U.S. Patent No. 6,456,844
U.S. Patent No. 7,408,907
U.S. Patent No. 5,850,596
U.S. Patent No. 7,206,840
U.S. Patent No. 7,483,711

c. **'376 Patent**

Patent No. / Publication
Prior art listed in the file history of the '376 Patent, or that of any related foreign or domestic patent applications
HOMERF
GSM
IS-95
WCDMA
CDMA2000
IEEE 802.11-1999
IEEE 802.11a-1999
IEEE 802.11b-1999
IEEE 802.11f-2003
IEEE 802.11g-2003
IEEE 802.11h-2003
Smart Antennas for Dummies (Author: Arild Jacobsen, ISBN: 82-423-0388-6)

Gerard. J. Foschini (October 1996), “Layered Space-Time Architecture for Wireless Communication in a Fading Environment When Using Multi-Element Antennas,” Bell Laboratories Technical Journal: 41–59.
P. W. Wolniansky; G. J. Foschini; G. D. Golden; R. A. Valenzuela (September 1998), “V-BLAST: An Architecture for Realizing Very High Data Rates Over the Rich-Scattering Wireless Channel,” Proc. URSI ISSSE: 295–300.
U.S. 4,750,147
U.S. 4,965,732
U.S. 5,515,378
U.S. 5,546,090
US 5,642,353
U.S. 5,553,074
U.S. 5,697,066
U.S. 5,739,788
U.S. 5,886,988
U.S. 5,890,067
U.S. 6,006,110
U.S. 6,067,290
U.S. 6,101,399
U.S. 6,219,561
U.S. 6,330,460
U.S. 6,351,499
U.S. 6,564,036
U.S. 6,665,545
U.S. 6,687,492
U.S. 6,795,409
U.S. 7,130,662
U.S. 7,212,499
U.S. 6,301,238
U.S. 6,621,454
WO00/072464
WO01/010156
WO03/075396
WO97/00543
WO97/33388
WO98/18271
“Adaptive Transmitting antenna arrays at the Base Station in Mobile Radio Networks,” Derek Gerlach
A.S. Acampora, S.V. Krishnamurthy, and M. Zorzi, “Media Access Protocols for Use with Smart Adaptive Array Antennas to Enable Wireless Multimedia Communications” Wireless Networks, Springer-Verlag, 1998.

Z.-S. Zhang and A.S. Acampora, "Performance of a Modified Polling Strategy for Broadband Wireless Access in a Harsh Fading Environment," <i>Telecommunication Systems</i> , Vol. 1, No. 3, 1993.
A. Acampora and S Krishnamurthy, "A New Adaptive MAC Protocol for Broadband Packet Networks in Harsh Fading and Interference Environments", <i>IEEE/ACM Transactions on Networking</i> , Vol. 8, No. 3, June 2000.
S.V. Krishnamurthy, A.S. Acampora, and M. Zorzi, "Polling-Based Media Access Protocols for Use with Smart Adaptive Array Antennas," <i>IEEE/ACM Trans. Networking</i> Vol. 9, No. 2, April 2001.
Z. Zhang and A.S. Acampora, "Performance of a Modified Polling Strategy for Broadband Wireless LANs in a Harsh Fading Environment," <i>IEEE GLOBECOM '91 Conference Record</i> , Dec. 1991, Phoenix.
S. Krishnamurthy, A. S. Acampora, and M. Zorzi, "Polling Based Media Access Protocols for Use With Smart Adaptive Array Antennas", <i>Conference Record, International Conference on Universal Personal Communications</i> , Florence, Oct., 1998.
A. S. Acampora and S. V. Krishnamurthy, "A New Adaptive MAC Layer Protocol for Wireless ATM Networks in Harsh Fading and Interference Environments," <i>IEEE Intl. Conf. Universal Personal Comm.</i> , San Diego, Oct. 1997.
A.S. Acampora and J.H. Winters, "A Wireless Network for Wide-Band Indoor Communications," <i>JSAC</i> , Vol. 5, No. 5, 1987.
A.S. Acampora and J.H. Winters, "System Applications for wireless Indoor Communications," <i>IEEE Communications Magazine</i> , Vol. 25, No. 8, 1987.
Yamaguchi et al., "4 GHz 8x8 Switch Matrix for SDMA System," <i>Microwave Symposium</i> , 1975 <i>IEEE-MTT-S International</i> .
Gerlach et al., "Spectrum Reuse Using Transmitting Antenna Arrays with Feedback," <i>Acoustics, Speech, and Signal Processing, ICASSP</i> , 1994.
S. Krishnamurthy, A. S. Acampora, and M. Zorzi, "Polling Based Media Access Protocols for Use With Smart Adaptive Array Antennas", <i>Conference Record, International Conference on Universal Personal Communications</i> , Florence, Oct., 1998.
A. S. Acampora and S. V. Krishnamurthy, "A New Adaptive MAC Layer Protocol for Wireless ATM Networks in Harsh Fading and Interference Environments," <i>IEEE Intl. Conf. Universal Personal Comm.</i> , San Diego, Oct. 1997.
Gerlach et al., "Adaptive Transmitting Antenna Arrays with Feedback," <i>IEEE Signal Processing Letters</i> , Oct. 1994.
Gerlach et al., "Base Station Transmitting Antenna Arrays for Multipath Environments," <i>Signal Processing</i> , Oct. 1996.
Foschini et al., "On Limits of Wireless Communications in a Fading Environment when Using Multiple Antennas," <i>Wireless Personal Communications</i> , 1998.
A. J. Paulraj and C. B. Papdrias, "Space-Time Processing for Wireless Communications," <i>IEEE Signal Processing Magazine</i> , pp. 49-83, November 1997.
U.S. 7,529,305
S. Anderson et al., "An Adaptive Array for Mobile Communication Systems," <i>IEEE Transactions on Vehicular Technology</i> , Vol. 40, No. 1, February 1991.
G. Foschini et al., "BLAST Bell Labs Layered Space Time", Bell Labs.

L.H. Brandenburg and A.D. Wyner, "Capacity of the Gaussian Channel with Memory, The Multivariate Case", The Bell System Technical Journal, Vol. 53, Issue 5, May-June 1974.
D. Chapman, "First-Hand: Sidelobe Cancellers and the Like", IEEE,
A.J. Fenn, et al., "The Development of Phased-Array Radar Technology", Lincoln Laboratory Journal Vol. 12, Number 2.
G.J. Foschini, "Layered Space-Time Architecture for Wireless Communication in a Fading Environment when Using Multi-Element Antennas", Bell Labs Technical Journal.
A.R. Kaye, "Transmission of Multiplexed PAM Signals Over Multiple Channel and Diversity Systems", IEEE Transaction on Communications, Vol. 18, No. 5.
G. Raleigh, et al., "Characterization of Fast Fading Vector Channels for Multi-Antenna Communication Systems", IEEE.
G.G. Raleigh, et al., "Spatio-Temporal Coding for Wireless Communications", IEEE Transactions on Communications, Vol. 46, No. 3.
D.O. Reudink, et al., "A Scanning Spot-Beam Satellite System", The Bell System Technical Journal.
S.C. Swales, et al., "Multi-Beam Adaptive Base-Station Antennas for Cellular Land Mobile Radio Systems", IEEE.
W. Van Etten, "Maximum Likelihood Receiver for Multiple Channel Transmission Systems", IEEE Transactions on Communications.
J.H. Winters, "Optimum Combining in Digital Mobile Radio with Cochannel Interference", IEEE Journal on Selected Areas in Communications, Vol. SAC-2, No. 4.
U.S. 5,345,599, A.J. Paulraj, et al., "Increasing capacity in wireless broadcast systems using distributed transmission/directional reception (DTDR)", Sept. 6, 1994.
U.S. 5,515,378, R.H. Roy III and Bjorn Ottersen, "Spatial Division Multiple Access Wireless Communication Systems", May 7, 1996.
U.S. 5,642,353, R.H. Roy III, et al., "Spatial Division Multiple Access Wireless Communication Systems", June 24, 1997.
M. Cooper, "A Layman's Guide to Cellular", Annual Review of Communications.
R.H. Roy, "Application of Smart Antenna Technology in Wireless Communication Systems".
B. Ottersten, "Array Processing for Wireless Communications".
M. Cooper, et al., "Intelligent Antennas: Spatial Division Multiple Access", Intelligent Antennas: Spatial Division Multiple Access, 1996 Annual Review of Communications.
"Intellicell: A Fully Adaptive Approach to Smart Antennas" ArrayComm, Inc., 2002
Commercial Deployment of Adaptive Antennas, Spectrum Management 2003, May 20-21, 2003
D. Nowicki, et al., "Smart Antenna Strategies", Mobile Communication International, April 1995.
M. Goldburg, et al., "The Impacts of SDMA on PCS System Design", IEEE.
J. Kang, et al., "Low Complexity Array Response Vector Estimation For Smart Antenna Systems", 2000 IEEE.
H. Li, et al., "Coded Beamforming for Block Fading Vector Channel", Dept. of Electrical and Computer Engineering, 2001, IEEE.
K.R. Dandekar, et al., "Effect of mutual coupling on direction finding in smart antenna applications", Electronics Letters, Oct. 26, 2000, Vol. 36, No. 22.

L. Bigler, et al., "Experimental Direction of Arrival and Spatial Signature Measurements at 900 MHz for Smart Antenna Systems", 1995 IEEE.
S-S. Jeng, et al., "Experimental Evaluation of Smart Antenna System Performance for Capacity Improvement", 1997 IEEE.
S-S. Jeng, et al., "Experimental Evaluation of Smart Antenna System Performance for Wireless Communications", IEEE Transactions on Antennas and Propagation, Vol., 46, No. 6, June 1998.
S-S Jeng, et al., "Experimental Studies of Spatial Signature Variation at 900 MHz for Smart Antenna Systems", 1998 IEEE.
K.R. Dandekar, et al., "Modeling And Prediction Of The Wireless Vector Channel Encountered By Smart Antenna Systems", Microwave And Optical Technology Letters, Vol. 35, No. 4, November 20, 2002.
S..C. Swales, et al., "Multi-Beam Adaptive Base-Station Antennas For Cellular Land Mobile Radio Systems", 1989 IEEE.
W. Yang, et al., "New Method for Designing Smart Antenna Downlink Weighting Vectors Based on the Filter Bank Concept", SPIE, Vol, 3162.
P. Balaban, et al., "Optimum diversity Combining and Equalization in Digital Data Transmission with Applications to Cellular Mobile Radio - Part I: Theoretical Considerations", 1992 IEEE.
J.A. Cadzow, et al., "Resolution Of Coherent Signals Using A Linear Array", 1987 IEEE.
G. Xu, et al., "Smart Antenna systems for Wireless Communications", 1988 IEEE.
J.H. Winters, et al., "The Impact of Antenna Diversity on the Capacity of Wireless Communication Systems", IEEE Transactions on Communications, Vol. 42, No. 2/3/4, February/March/April 1994.
H. Li, et al., "Transmission Optimization Over Flat Rayleigh Fading channel with Multiple Antennas", 1999 IEEE.
A. Kavak, et al., "Vector Channels for Smart Antennas - Measurements, Statistical Modeling, and Directional Properties in Outdoor Environments", IEEE Transactions On Microwave Theory And Techniques, Vol, 48, No. 6, June 2000.
A.F. Naguib, et al., "Performance Of CDMA Cellular Networks With Base-Station Antenna Arrays: The Downlink", 1994 IEEE.
U.S. 5,914,946, D. Avidor, et al., "TDM-Based Fixed Wireless Loop System", Jun. 22, 1999.
US 5,687,194 E. Paneth, et al., "Subscriber RF Telephone System For Providing Multiple Speech And/Or Data Signals Simultaneously Over Either A Single Or A Plurality Of RF Channels".
U.S. 5,828,658, B.E. Ottersten, et al., "Spectrally Efficient High Capacity Wireless Communication Systems With Spatio-Temporal Processing", Oct. 27, 1998.
J. Liang & A. Paulraj, "Forward link antenna diversity using feedback for indoor communication systems", IEEE, 1995 International Conference on Acoustics, Speech, and Signal Processing, Vol. 3, pp. 1753-5
D. Gerlach & A. Paulraj, "Base station transmitter antenna arrays with mobile to base feedback", IEEE, Proceedings of 27th Asilomar Conference on Signals, Systems and Computers, Vol. 2, pp. 1432-6

A. Naguib, A. Paulraj, & T. Kailath, "Capacity improvement of base-station antenna arrays cellular CDMA", IEEE, Proceedings of 27th Asilomar Conference on Signals, Systems and Computers, Vol. 2, pp. 1437-41
G. Raleigh & V. K. Jones, "Adaptive Antenna Transmission for Frequency Duplex Digital Wireless Communication", IEEE, 1997 IEEE International Conference on Communications, Vol. 2, pp. 641-6
P. Lehne & M. Petterson, "An overview of smart antenna technology for mobile communications systems", IEEE Communications Surveys, Fourth Quarter 1999, Vol. 2, No. 4
A. Paulraj, "Smart antennas for battlefield multimedia wireless networks with dual use applications" (August 1998)
D. Gerlach, "Adaptive Transmitting antenna arrays at the Base Station in Mobile Radio Networks" (August 1995)
Yee, Limmartz, & Fettweis, "Multicarrier CDMA in indoor wireless radio networks", Proc. PMIRC '93, Yokohoma, Japan, pp. 109-113, September 1993
"Essentials of ATM Networks," Oliver C. Ibe, Addison-Wesley 1997
"Computer Networks", Andrew S. Tanenbaum, 3d Ed. Prentice Hall PTR 1996
T.E. Curtis, "Digital Beamforming for Sonar System," IEEE Proc. Pt. F, Vol. 127 pp. 257-265, Aug. 1980
P. Barton, "Digital Beamforming for radar", I IEEE Proc. Pt. F., Vol. 266-267, Aug. 1980
S. Applebaum, "Adaptive Arrays," IEEE Trans. On Antennas and Propagation, Vo. AP-24, No. 5, pp. 585-598, Sep. 1976
R. T. Compton, Jr., <i>Adaptive Antennas: Concepts and Applications</i> , Prentice Hall, Englewood Cliffs, NJ, 1988
J.E. Hudson, <i>Adaptive Array Principles</i> , Peregrinus, London 1981
R. A. Monzingo & T.W. Miller, <i>Introduction to Adaptive Arrays</i> , John Wiley & Sons, 1980
W.F. Gabriel, "Adaptive Arrays – an introduction," Proc. IEEE, vol 64, pp. 239-272, Feb. 1976
B.D. Van Veen & K.M. Buckley, "Beamforming: A versatile approach to spatial filtering," IEEE ASSP Magazine, vol. 5, pp. 4-24, Apr. 1998
B. Widrow, P. E. Mantey, L. J. Griffiths, and B.B. Goode, "Adaptive Antenna Systems," Proc. IEEE, vol. 55, pp. 2143-2159, Dec. 1967
R. T. Compton, R. J. Huff, W.G. Swarner, and A. A. Ksienki, "Adaptive Arrays for Communication Systems: An overview of research at the Ohio State University", IEEE Trans. Antennas Propagation, vol. AP-24, pp. 599-607, 1976
B.G. Agee, S.V. Schell, and W. A. Gardner, "Spectral Self-Coherence Restoral: A New Approach to Blind Adaptive Signal Extraction Using Antenna Arrays," Proc. IEEE, vo. 78, pp. 753-767, Apr. 1990
Q. Wu, K.M Wong, and R. Ho, "A fast algorithm for adaptive beamforming of cyclic signals," IEEE Proc. Pt. F, vo.. 141, pp. 312-318, Dec. 1994
J. H. Winters, "Increased Data Rate for Communication Systems with Adaptive Antennas," Proc. IEEE Int. Conf. Comm., June 1982

Y.S. Yeh and D. O. Reudink, "Efficient Spectrum Utilization for Mobile Radio Systems Using Space Diversity," IEEE Int. Conf. Radio Spectrum Conservation Techniques, London, pp. 12-16, 1980
Y. S. Yeh and D. O. Reudink, "Efficient Spectrum Utilization for Mobile Radio Systems Using Space Diversity," IEEE Trans. Comm. Vo. COM-30, pp. 447-455, March 1982
J. H. Winters, "Optimum combining in digital mobile radio with co-channel interference," <i>IEEE Trans. Veh. Technol.</i> , vol 33. Pp. 144-155, Aug. 1984
U.S. Patent No. 7,200,368
U.S. Patent No. 7,079,514
U.S. Patent No. 6,232,921
U.S. Patent No. 6,219,561
U.S. Patent No. 6,108,565
U.S. Patent No. 6,901,062
U.S. Patent No. 7,139,324
U.S. Patent No. 7,054,662
U.S. Patent No. 7,499,499
U.S. Patent No. 7,447,270
U.S. Patent No. 6,347,234
U.S. Patent No. 6,980,832
U.S. Patent No. 6,501,747
U.S. Patent No. 7,050,480
U.S. Patent No. 7,039,441
U.S. Patent No. 5,815,116
U.S. Patent No. 6,188,913
U.S. Patent No. 6,496,535
U.S. Patent No. 6,834,076
U.S. Patent No. 7,088,782
U.S. Patent No. 7,310,304
U.S. Patent No. 7,706,458
U.S. Patent Publication No. 2002/0086708
U.S. Patent Publication No. 2003/0017853
U.S. Patent No. 6,553,012
U.S. Patent No. 6,970,722
U.S. Patent No. 7,042,394
U.S. Patent Publication No. 2003/0060205
U.S. Patent No. 6,738,020
U.S. Patent No. 6,795,409
U.S. Patent No. 7,529,525
L. Chen et al., "A Dynamic Channel Assignment Algorithm for Cellular System with Adaptive Array Antennas," IEEE Veh. Tech. Conf. 2001.

S. Perreau, "Combined Downlink Beamforming and Channel Estimation for High Data Rate CDMA Systems," Proc. IEEE Signal Processing Workshop on Statistical Signal Processing (2001)
F. Rashid Farrokhi et al, "Transmit Beamforming Power Control for Cellular Wireless Systems," 16 IEEE J. on Selected Areas in Comm'n 1437 (1998)
S. Choi et al., "Transmitter Power Control (TPC) and Dynamic Frequency Selection (DFS) Joint Proposal for 802.11h WLAN," IEEE 802.11-01/169r2
M. Ghosh et al, "On the Use of Multiple Antennae for 802.11," IEEE 802.11-02/180r0
H. Yu, "HDR 802.11a Solution Using MIMO-OFDM," IEEE 802.11-02/294r1
J. Regnier, "Benefits of Smart Antennas in 802.11 Networks," IEEE 802.11-03/025r0
A. van Zelst et al., "Space Division Multiplexing (SDM) for OFDM Systems," 51 IEEE Veh. Tech. Conf., Vol. 2, pp. 1070-1074 (Spring 2000)
A. Hori et al, "System Capacity and Cell Radius Comparison with Several High Data Rate WLANs" IEEE 802.11-02/159r1
P. Brenner, "A Technical Tutorial on the IEEE 802.11 Protocol," Breezcom Wireless Communications (July 18, 1996)
Siemens AG & Technical University of Munich, "Advanced closed loop Tx diversity concept (eigenbeamformer)," 3GPP TSGR1#14(00)0853, July 2000
H. Holma & A. Toskala, "WCDMA for UMTS," John Wiley & Sons, 2000

d. '511 Patent

Patent No. / Publication
Prior art listed in the file history of the '511 Patent, or that of any related foreign or domestic patent applications
Andrews, et. al., "Fundamentals of WiMAX". Publisher : Prentice Hall; 1st edition (February 27, 2007), ISBN-10 : 0132907801, ISBN-13 : 978-0132907804
Ghosh, et. al. "Fundamentals of LTE", (Prentice Hall Communications Engineering and Emerging Technologies Series) (2010)
Perahia, "Next Generation Wireless LANs". Cambridge University Press, 2008 (1 st Edition)

e. '369 Patent

Patent No. / Publication
Prior art listed in the file history of the '369 Patent, or that of any related foreign or domestic patent applications
Holma (referenced in '376 list above)
Yang, "CDMA RF System Engineering", Publisher: Artech House Publishers, Publication date: April 30, 1998, ASIN: B0048D4TXK.
Litva, et al, "Digital Beamforming in Wireless Communications", Artech House Publishers, Publication date: August 31, 1996 ISBN 10: 0890067120 / ISBN 13: 9780890067123
Van Nee, et al, "OFDM for Wireless Multimedia Communications" Artech House Publishers, Publication date: December 31, 1999, ISBN-10 : 9780890065303, 0890065306.

Heiskala and Terry, "OFDM Wireless LANs: A Theoretical and Practical Guide", Publisher Sams, Publication date: 2001 (showing general state of the art); ISBN-10 : 0672321572; ISBN-13 : 978-0672321573
EP 0991202, priority date 1998-01-10, published 2000-05-04, prior art under 102(a)(b)
USP 6,377,631, filing date 1999-11-05, issued 2002-04-23, prior art under 102(a)(b)(e)(g)
USP 6,711,123, filing date January 31, 2000, issued March 23, 2004 , prior art under 102(a)(e)(g)
USP 6,834,043, filing date July 24, 2000, issued December 21, 2004, prior art under 102(a)(e)(g)
USP 7,054,375, filing date December 22, 2000, issued May 30, 2006, prior art under 102(a)(e)(g). ("Kannan 375")
USP 7,110,378, filing date October 3, 2001 (claiming priority to U.S. Provisional 60/237,626 filed October 3, 2000), issued September 19, 2006, prior art under 102(a)(e)(g). ("Onggosanusi 378")
USP 6,144,711, filing date August 27, 1997, issued date November 7, 2000, prior art under 102(a)(b)(e)(g). ("Raleigh 711")
USP 5,513,215, filing date September 20, 1993, issued date April 30, 1996, prior art under 102(a)(b)(e)(g).
US Published Application 20020142782, filing date January 16, 2001, published October 3, 2002, prior art under 102(a)(e)(g).

2. Obviousness

Defendants contend that, to the extent the primary references identified in these Preliminary Invalidity Contentions do not anticipate the Asserted Claims, it would have been obvious to combine any of the references, systems, concepts, or technologies discussed in this Section with those primary references. Defendants also reserve the right to rely on the discussions of the state of the art and prior art in each of the Asserted Patent specifications and their file histories including foreign file histories of related patents in explaining the state of the art. Defendants further expressly reserve the right to supplement their summary of the background and state of the art, including, for example, with information from any of the authors or named inventors on any of the prior art references, by personnel familiar with systems based on any of the prior art references, or any prior art systems related to prior art references, or by technical experts retained on behalf of any party. Defendants also expressly reserve the right to rely on any

admissions by any of the named inventors, institutions with which they were associated, and XR, regarding the state of the art.

a. '235 Patent

In the following discussion, the claim elements refer to the elements as charted in the charts for Exhibits A (e.g., A-01). In the asserted combinations between two or more references that are charted in the Exhibit A charts, the combination would be to use the citations for one of the elements (as shown in the charts) from the reference(s) to fill in the gaps for the other reference(s). For example, if XR alleges that element 1[b] is not present in chart A-01, the combination of A-01 and A-02 would include the content of A-02 for element 1[b].

Weight Computations. Elements [1g], [8d], and [15g] refer to computing weights that are subsequently used for transmit beamforming. Under XR's apparent application of the claims, such weight computations were well-known prior to the priority date of the '235 Patent. References that teach these limitations include: Banister 758 (see A-1 chart at element [1g]), Lindskog (see A-02 chart at element [1g]), Foschini (see A-03 chart at element [1g]), Scherzer 647 (see A-04 chart at element [1g]), Xu (see A-05 chart at element [1g]), Ylitalo (see A-07 chart at element [1g]), Kim 983 (see A-08 chart at element [1g]), Yoshida 901 (see A-09 at element [1g]), Cyzs (see A-10 chart at element [1g]), Harrison (see A-11 chart at element [1g]), Levy 643 (see A-12 chart at element [1g]), Hottinen 286 (see A-13 chart at element [1g]), Burke (see A-14 chart at element [1g]), Alamouti (see A-15 chart at element [1g]), Motorola 3GPP (see A-16 chart at element [1g]), Kuwahara (see A-17 chart at element [1g]), Paulraj 290 (see A-18 chart at element [1g]), Ottersten (see A-20 chart at element [1g]), Jang (see A-21 chart at element [1g]), Gerlach 647 (see A-22 chart at element [1g]), Kim 530 (see A-23 chart at element [1g]), Hottinen 2000 (see A-24 chart at element [1g]), Gerlach 1993 (see A-25 chart at element [1g]), Raghothaman (see A-26 chart at element [1g]), Katz (see A-27 chart at element [1g]), Derryberry (see A-28 chart

at element [1g]), Walton 040 (see A-29 chart at element [1g]), Agee 841 (see A-30 chart at element [1g]), Viswanath (see A-31 chart at element [1g]), Haardt 586 (see A-32 chart at element [1g]), Youssefmir 567 (see A-33 chart at element [1g]), Hottinnen 818 (see A-34 chart at element [1g]), Saunders 877 (see A-35 chart at element [1g]), Jitsukawa (see A-36 chart at element [1g]), Kim 381 (see A-37 chart at element [1g]), Kim 723 (see A-38 chart at element [1g]), Banister 2002 (see A-39 chart at element [1g]), Crilly (see A-40 chart at element [1g]), Gerlach 199 (see A-41 chart at element [1g]), Scherzer 258 (see A-42 chart at element [1g]), Ketchum (see A-43 chart at element [1g]), Agee 923 (see A-44 chart at element [1g]), Proctor 036 (see A-45 chart at element [1g]).

The motivation to combine with each of these references (beyond the other motivations identified herein) includes several factors including: (1) express statements regarding the benefits of beamforming, (2) express statements that weight computations were used for transmit beamforming, and (3) the knowledge of a POSITA recognizing that transmit beamforming and weight computations were well-known and in use.

Channel State Information. Elements [1e], [1f], [8b], [8c], [15e], and [15f] refer to gathering channel state information from received signals. Under XR's apparent application of the claims, such weight computations were well-known prior to the priority date of the '235 Patent. References that teach these limitations include: Banister 758 (see A-1 chart at element [1e]-[1f]), Lindskog (see A-02 chart at element [1e]-[1f]), Foschini (see A-03 chart at element [1e]-[1f]), Scherzer 647 (see A-04 chart at element [1e]-[1f]), Xu (see A-05 chart at element [1e]-[1f]), van Nee (see A-06 chart at element [1e]-[1f]), Ylitalo (see A-07 chart at element [1e]-[1f]), Kim 983 (see A-08 chart at element [1e]-[1f]), Yoshida 901 (see A-09 at element [1e]-[1f]), Cyzs (see A-10 chart at element [1e]-[1f]), Harrison (see A-11 chart at element [1e]-[1f]), Levy 643 (see A-12

chart at element [1e]-[1f]), Hottinen 286 (see A-13 chart at element [1e]-[1f]), Burke (see A-14 chart at element [1e]-[1f]), Alamouti (see A-15 chart at element [1e]-[1f]), Motorola 3GPP (see A-16 chart at element [1e]-[1f]), Kuwahara (see A-17 chart at element [1e]-[1f]), Paulraj 290 (see A-18 chart at element [1e]-[1f]), Heath 2001 (see A-19 chart at [1e]-[1f]), Ottersten (see A-20 chart at element [1e]-[1f]), Jang (see A-21 chart at element [1e]-[1f]), Gerlach 647 (see A-22 chart at element [1e]-[1f]), Kim 530 (see A-23 chart at element [1e]-[1f]), Hottinen 2000 (see A-24 chart at element [1e]-[1f]), Gerlach 1993 (see A-25 chart at element [1e]-[1f]), Raghothaman (see A-26 chart at element [1e]-[1f]), Katz (see A-27 chart at element [1e]-[1f]), Derryberry (see A-28 chart at element [1e]-[1f]), Walton 040 (see A-29 chart at element [1e]-[1f]), Agee 841 (see A-30 chart at element [1e]-[1f]), Viswanath (see A-31 chart at element [1e]-[1f]), Haardt 586 (see A-32 chart at element [1e]-[1f]), Youssefmir 567 (see A-33 chart at element [1e]-[1f]), Hottinen 818 (see A-34 chart at element [1e]-[1f]), Saunders 877 (see A-35 chart at element [1e]-[1f]), Jitsukawa (see A-36 chart at element [1e]-[1f]), Kim 381 (see A-37 chart at element [1e]-[1f]), Kim 723 (see A-38 chart at element [1e]-[1f]), Banister 2002 (see A-39 chart at element [1e]-[1f]), Crilly (see A-40 chart at element [1e]-[1f]), Gerlach 199 (see A-41 chart at element [1e]-[1f]), Scherzer 258 (see A-42 chart at element [1e]-[1f]), Ketchum (see A-43 chart at element [1e]-[1f]), Agee 923 (see A-44 chart at element [1e]-[1f]), Proctor 036 (see A-45 chart at element [1e]-[1f]).

The motivation to combine with each of these references (beyond the other motivations identified herein) includes several factors including: (1) express statements regarding the need to compute channel state information, (2) express statements that channel state information was used for transmit beamforming, and (3) the knowledge of a POSITA recognizing that determining channel state information was well-known and in use.

b. '939 Patent

In the following discussion, the claim elements refer to the elements as charted in the charts for Exhibits B (e.g., B-01). In the asserted combinations between two or more references that are charted in the Exhibit B charts, the combination would be to use the citations for one of the elements (as shown in the charts) from the reference(s) to fill in the gaps for the other reference(s). For example, if XR alleges that element 30[b] is not present in chart B-01, the combination of B-01 and B-02 would include the content of B-02 for element 30[b].

Plurality of Access Points. Elements [30a] and [15a] refer to a wireless input/output unit that establishes a plurality of access points. Under XR's apparent application of the claims, such configurations were well-known prior to the priority date of the '939 Patent. References that teach these limitations include Souissi (see B-01 chart at element [30a]), Johansson (see B-02 chart at element [30a]), Kasami 501 (see B-03 chart at element [30a]), Kasami 860 (see B-04 chart at element [30a]), Mansfield (see B-05 chart at element [30a]), Scherzer (see B-07 chart at element [30a]), Jaszewski (see B-08 chart at element [30a]), Hansen (see B-09 chart at element [30a]), Busch (see B-10 chart at element [30a]), 802.11-1999 (see B-11 chart at element [30a]), 802.11h Proposal (see B-12 chart at element [30a]), Holma (see B-13 chart at element [30a]), Katzela (see B-14 chart at element [30a]), Gibson (see B-15 chart at element [30a]), Reudink (see B-17 chart at element [30a]), AP-1000 (see B-18 chart at element [30a]), Fujinami (see B-19 chart at element [30a]), Parantainen (see B-20 chart at element [30a]), McHenry (see B-21 chart at element [30a]), Gibbons (see B-22 chart at element [30a]), Proctor (see B-23 chart at element [30a]), Hamalainen (see B-24 chart at element [30a]), Watanabe (see B-25 chart at element [30a]), Sashihara (see B-26 chart at element [30a]).

The motivation to combine with each of these references (beyond the other motivations identified herein) includes several factors including: (1) express statements regarding the benefits

of multiple access points or base stations, and (2) the knowledge of a POSITA recognizing that multiple access points/base stations were well-known and in use.

Restraining Transmission. Elements [30b] and [15d] recite restraining an access point from transmitting on a given channel upon ascertaining that another access point is receiving a signal on a different channel. Under XR's apparent application of the claims, these limitations were well-known prior to the priority date of the '939 Patent. References that teach these limitations include: Souissi (see B-01 chart at element [30b]), Johansson (see B-02 chart at element [30b]), Kasami 501 (see B-03 chart at element [30b]), Kasami 860 (see B-04 chart at element [30b]), Mansfield (see B-05 chart at element [30b]), Scherzer (see B-07 chart at element [30b]), Jaszewski (see B-08 chart at element [30b]), Hansen (see B-09 chart at element [30b]), Busch (see B-10 chart at element [30b]), 802.11-1999 (see B-11 chart at element [30b]), 802.11h Proposal (see B-12 chart at element [30b]), Holma (see B-13 chart at element [30b]), Katzela (see B-14 chart at element [30b]), Gibson (see B-15 chart at element [30b]), Roman (see B-16 chart at element [30b]), Reudink (see B-17 chart at element [30b]), AP-1000 (see B-18 chart at element [30b]), Fujinami (see B-19 chart at element [30b]), Parantainen (see B-20 chart at element [30b]), McHenry (see B-21 chart at element [30b]), Gibbons (see B-22 chart at element [30b]), Proctor (see B-23 chart at element [30b]), Hamalainen (see B-24 chart at element [30b]), Watanabe (see B-25 chart at element [30b]), Sashihara (see B-26 chart at element [30b]).

The motivation to combine with each of these references (beyond the other motivations identified herein) includes several factors including: (1) express statements regarding the benefits of restricting transmission on certain channels because of interference, (2) dynamic channel selection and channel reassignment, and (3) the knowledge of a POSITA recognizing the benefits of dynamic channel assignment and reassignment.

c. '376 Patent

In the following discussion, the claim elements refer to the elements as charted in the charts for Exhibits C (e.g., C-01). In the asserted combinations between two or more references that are charted in the Exhibit C charts, the combination would be to use the citations for one of the elements (as shown in the charts) from the reference(s) to fill in the gaps for the other reference(s). For example, if XR alleges that element 1[c] is not present in chart C-01, the combination of C-01 and C-02 would include the content of C-02 for element 1[c].

Transmission Peaks and Transmission Nulls. Elements [1k], [1o], [12k], [12o], [22m], [22q], [32o], [32s], and claim 8 recite the steps of determining where to place transmission peaks and transmission nulls based in part on feedback information, including placing transmission peaks and transmission nulls at locations of client devices. Such techniques were well-known prior to the priority date of the '376 Patent. References that teach these limitations include: Kanamaluru (see C-01 chart at elements [1k], [1o]), Lewis (see C-03 chart at [1k], [1o]), Gurelli (see C-05 chart at [1k], [1o]), Gerlach 647 (see C-06 chart at [1k], [1o]), Gerlach 199 (see C-07 chart at [1k], [1o]), Crilly (see C-08 chart at [1k], [1o]), Kasami 430 (see C-11 chart at [1k], [1o]), Shapira (see C-12 chart at [1k], [1o]), Lindskog (see C-13 chart at [1k], [1o]), Youssefmir (see C-14 chart at [1k], [1o]), Agee (see C-15 chart at [1k], [1o]), Reudink (see C-16 chart at [1k], [1o]), Jia (see C-18 chart at [1k], [1o]), Perreau (see C-20 chart at [1k], [1o]), Gerlach-AT (see C-21 chart at [1k], [1o]), Gerlach Thesis (see C-22 chart at [1k], [1o]), Godara (see C-23 chart at [1k], [1o]), Hovers (see C-26 chart at [1k], [1o]), Vook (see C-27 chart at [1k], [1o]), Lehne (see C-28 chart at [1k], [1o]), Litva (see C-29 chart at [1k], [1o]).

The motivation to combine with each of these references (beyond the other motivations identified herein) includes several factors including: (1) express statements regarding the benefits of placing transmission peaks and transmission nulls, (2) express statements regarding the benefits

of beamforming, and (3) the knowledge of a POSITA recognizing that beamforming provided benefits including increased transmission range as well as reduced signal to noise ratio, and further enabled efficient spectrum reuse.

Smart Antennas. Elements [1f], [1g], [12f], [12g], [22f], [22g], [32f], and [32g] recite a smart antenna. Smart antennas were well-known prior to the priority date of the '376 patent. References that teach smart antennas include: Kanamaluru (see C-01 chart at elements [1f], [1g]), Lewis (see C-03 chart at [1f], [1g]), Kasami 501 (see C-04 chart at [1f], [1g]), Gurelli (see C-05 chart at [1f], [1g]), Gerlach 647 (see C-06 chart at [1f], [1g]), Gerlach 199 (see C-07 chart at [1f], [1g]), Crilly (see C-08 chart at [1f], [1g]), Carloni (see chart C-09 at [1f], [1g]), Sayers (C-10) (see chart C-10 at [1f], [1g]), Kasami 430 (see C-11 chart at [1f], [1g]), Shapira (see C-12 chart at [1f], [1g]), Lindskog (see C-13 chart at [1f], [1g]), Youssefmir (see C-14 chart at [1f], [1g]), Agee (see C-15 chart at [1f], [1g]), Reudink (see C-16 chart at [1f], [1g]), Barratt (see C-17 chart at [1f], [1g]), Jia (see C-18 chart at [1f], [1g]), Chen (see C-19 chart at [1f], [1g]), Perreau (see C-20 chart at [1f], [1g]), Gerlach-AT (see C-21 chart at [1f], [1g]), Gerlach Thesis (see C-22 chart at [1f], [1g]), Godara (see C-23 chart at [1f], [1g]), Rashid-Farrokhi (see C-25 chart at [1f], [1g]), Hovers (see C-26 chart at [1f], [1g]), Vook (see C-27 chart at [1f], [1g]), Lehne (see C-28 chart at [1k], [1o]), Litva (see C-29 chart at [1k], [1o]).

The motivation to combine with each of these references (beyond the other motivations identified herein) includes several factors including: (1) express statements regarding the benefits of antenna arrays, and (2) the knowledge of a POSITA that antenna arrays enabled spectral reuse.

Feedback Information. Elements [1i], [1j], [1k], [12i], [12j], [12k], [22i]-[22m], [32k]-[32o], and claims 7 and 18 recite receiving feedback information, including in response to a probing signal. Receiving such feedback information was well-known prior to the priority date of

the '376 patent. References that teach receiving feedback information include: Kasami 501 (see chart C-04 at [1i]-[1k]), Gurelli (see chart C-05 at [1i]-[1k]); Gerlach 647 (see chart C-06 at [1i]-[1k]), Crilly (see chart C-08 at [1i]-[1k]), Linskog (see chart C-13 at [1i]-[1k]), Youssefmir (see chart C-14 at [1i]-[1k]), Gerlach AT (see chart C-21 at [1i]-[1k]), Rashid-Farrokhi (see chart C-25 at [1i]-[1k]), Vook (see chart C-27 at [1i]-[1k]), Litva (see chart C-29 at [1i]-[1k]).

The motivation to combine with each of these references (beyond the other motivations identified herein) includes several factors including: (1) express statements regarding the benefits receiving feedback information from client devices, and (2) the knowledge of a POSITA that such feedback information was necessary for obtaining channel state information in certain scenarios, such as in instances where the channel was not reciprocal.

d. '511 Patent

In the following discussion, the claim elements refer to the elements as charted in the charts for Exhibits D (e.g., D-01). In the asserted combinations between two or more references that are charted in the Exhibit D charts, the combination would be to use the citations for one of the elements (as shown in the charts) from the reference(s) to fill in the gaps for the other reference(s). For example, if XR alleges that element 1[c] is not present in chart D-01, the combination of D-01 and D-02 would include the content of D-02 for element 1[c].

Antenna Spacing. Claims 4 and 13 require “the m antenna arrays are separate by a distance more than one wavelength apart at the carrier frequency.” Claims 5 and 14 recite “the antenna elements are less than or equal to one half wavelength apart at the carrier frequency.” The ‘511 patent does not teach anything about the specific need for such spacings. Rather, in one passage, it merely parrots the claim language. Thus, the ‘511 patent is merely relying upon the knowledge of a POSITA and such knowledge is available for an invalidity analysis as well.

Moreover, the spacing of different aspects of the antenna arrays is well known and disclosed by many different references as discussed below. These are the Antenna Spacing references.

With respect to claims 4 and 13, these claims recite a spacing relevant to the MIMO capabilities performed by the arrays. A POSITA would have understood that a distance of greater than one wavelength provides advantages with respect to MIMO including an increased transmission capacities. As reflected in the references below, a POSITA would have understood that the sources of the MIMO transmissions (e.g., the different arrays) are optimally uncorrelated / not correlated. A POSITA understood that the typical recommendation for antenna spacing at a base station was 10 wavelengths as discussed below.

With respect to claims 5 and 14, these claims recite a spacing relevant to the beam-forming performed by the antenna elements. A POSITA would have understood that a distance of less than one half the wavelength for the inter element spacing because those elements are beam used to create the beams. This provides advantages with respect to beam forming.

Claims 6 and 15 require an “electronic beamformer.” The meaning of this term is not clear. It would appear to encompass beamforming that is accomplished by mechanical steering as the steering element is electronic. Regardless, each of the references below teach an “electronic beamformer” within the meaning of the ‘511 patent and its claims.

The Antenna Spacing references disclose:

Barak. See 15:37-49 (“One proposed antenna configuration, illustrated schematically in FIG. 5a, involves allocating antennas to create two groups 80, 82 of antennas, each having three omni-directional antennas arranged in a triangle (as shown in hardware in FIG. 3a). As seen in FIG. 5a, the antenna groups 80 and 82 are spatially separated, with the **distance d** between

antennas in each group typically being $\lambda/2$, with distance L between two groups, typically $>5\lambda$. Alternatively, two groups of three omni-antennas can be utilized at smaller spatial distances, i.e. $L < 5\lambda$, with polarization, i.e., one group being vertically polarized and the second being horizontally polarized, as when there is a 90° mechanical angular spatial separation between the antennas.”)

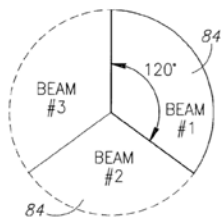
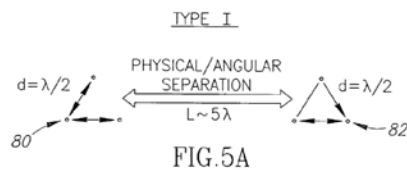


FIG. 5B

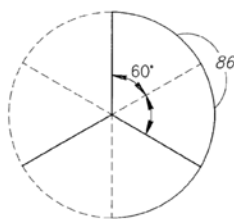


FIG. 5C

Lehne. Lehne contains extensive teachings about “smart antenna” arrays. See “Basic Principles” at pp. 3-4 (“By maximizing the antenna gain in the desired direction and simultaneously placing minimal radiation pattern in the directions of the interferers, the quality of the communication link can be significantly improved. In personal and mobile communications, the interferers are other users than the user being addressed. Normally, the term “antenna” comprises only the mechanical construction transforming free electromagnetic (EM) waves into radio frequency (RF) signals traveling on a shielded cable and vice versa. We may call it *the radiating element*. In the context of smart antennas, the term “antenna” has an extended meaning. It consists of a number of radiating elements, a combining/dividing network and a control unit. The control unit can be called the smart antenna’s intelligence, normally realized using a digital

signal processor (DSP). The processor controls feeder parameters of the antenna, based on several inputs, in order to optimize the communications link”). Lehne teaches different forms of arrays that create beams and these include electronic beamforming. See p. 4 Levels of Intelligence section; Figure 3. Lehne teaches several motivations to combine beamforming in the “Improvements and Benefits” on p. 5. Lehne teaches and shows the ability to generate many different beams using Array Antennas. See Array Antennas section, pp. 6-7; Figures 6, 12, 13, 14, 15, 16. Lehne teaches how to arrange the array antennas for beamforming for both receiving and transmitting. See pp. 8-11. Finally, in discussing the structure and the “physical size” of the antenna elements, Lehne expressly notes that “**Physical Size** — For the smart antenna to obtain a reasonable gain, an array antenna with several elements is necessary. Typically arrays consisting of six to 10 horizontally separated elements have been suggested for outdoor mobile environments [9–11]. The necessary element spacing is 0.4–0.5 wavelengths. This means that an eight-element antenna would be approximately 1.2 meters wide at 900 MHz and 60 cm at 2 GHz. With a growing public demand for less visible base stations, this size, although not excessive, could provide a problem. Figure 5 shows a picture of an eight-element antenna array at 1.8 GHz.”

Litva. Litva contains extensive teachings regarding antenna technology including beamforming. E.g., Chapter 2 (laying out the “Fundamentals of Digital Beamforming” including different types of arrays); p. 16 (“In an antenna array, if the element spacing is too large, several main lobes will be formed in visible space on each side of the array plane....”); see pp. 16-17 (teaching the “interelement spacing” for a linear array; see section 3.1 (“Basic concepts”); pp. 143-144 (avoiding “grating lobe effects due to large element spacing ... by making the antenna element spacing sufficiently small”);

Molisch. Molisch contains extensive teachings regarding antenna technologies, MIMO and beamforming. See, for example, section on “Spatial Diversity” at pp. 252-254 (noting that for “BS in cellular systems ... antenna spacing required to obtain sufficient decorrelation increases” and that ““that antenna spacing has to be on the order of 2-20 wavelengths” to achieve the desired goals of decorrelation). For MIMO, Molisch teaches the benefits of antenna spacing (e.g., between arrays) of greater than 1 wavelength to achieve capacity improvements. E.g., Figure 20.15 and pp. 473-474 teaching that “correlation of the signals... can significantly reduce the capacity of a MIMO system ...” and that “correlation is influenced by spacing of antenna elements (see Chapter 13)...”). See also pp. xxvii (“Chapter 20 finally discusses multiple-antenna techniques: “smart antennas,” typically placed at the base station, are multiple-antenna elements with sophisticated signal processing that can (among other benefits) reduce interference and thus increase the capacity of cellular systems. MIMO (multiple-input-multiple-output) systems go one step further, allowing the transmission of parallel data streams from multiple-antenna elements at the transmitter, which are then received and demodulated by multiple-antenna elements at the receiver. These systems achieve a dramatic capacity increase even for a single link.”); see p. 446 (“Purpose” which includes MIMO and beamforming” for an “increase of capacity”); See section 20.1.5 (using antenna weights for beamforming); see 20.2.10 “MIMO systems can be used to achieve spatial multiplexing, diversity and/or beamforming...”).

Agee 923. See Figure 6 and 7 (teaching a set of antenna arrays with multiple elements used for MIMO and beamforming and 68:30-53(“FIGS. 6 and 7 show alternative embodiments of the directional antenna arrays 120 that may be used in the system of the present invention. A first embodiment of the base station antenna implementation is designated generally as 120 *a*. The antenna 120 *a* is a circular patch slot array antenna including a protective RADOME 505 available

from RADIX Technologies, Inc. of Mountain View, Calif., a generally cylindrical housing 507, and a support pole 510. A plurality of multi-element vertical patch arrays 515 are depicted in cutaway in FIG. 6. Each of the patch arrays 515 are capable of directionally emitting radio frequency signals so as to provide beam forming capabilities necessary for the proper implementation of the present invention. In one embodiment, the height of the cylindrical portion 507 is approximately 18", while the diameter of the RADOME 505 is approximately 5-16". In one advantageous embodiment, the antenna 120 *a* includes a vertical stack of 4 microstrip patch antennas. Four of these stacks will respectively be oriented to cover four 90° quadrants. Thus, a total of 16 circumferential stacks of microstrip flared-notch antennas (where each vertical stack comprises eight notches) will be included on the base antenna 120 *a*. For both the remote and base antennas, **the preferred sensor element spacing is one-half wavelength.**")

Rudrapatna, US20020132600A1 (cited in prosecution history for claims 4 and 5). See 0007 ("Signal correlation is a phenomenon whereby the variations in the parameters (i.e., amplitude and phase) of a first signal of a first antenna track the variations in the parameters of a second signal of a second antenna in the vicinity of the first antenna. In general, as the spacing between antennas increases, the correlation between signals being transmitted (or received) by the antennas decreases. Conversely, as the spacing between antennas decreases, the correlation between signals being transmitted (or received) by the antennas increases. To achieve relatively highly correlated signals in typical wireless communication systems, the spacing between antennas is of the order of $\{fraction (1/2)\}\lambda$ or less where λ is equal to $\{fraction (c/f)\}$ which is the wavelength corresponding to the largest frequency (f) within a band of frequencies at which the antennas are operating; c is the well known constant representing the speed of light in vacuum. It is desirable to have relatively high correlation between signals transmitted (or received) by

antennas being used for beam forming/steering applications such as Steered STS. On the other hand, it is desirable to have a relatively low correlation or no correlation between antennas when they are used for MIMO applications such as BLAST or diversity applications.”); [0030 – 0031] (“[0030] The first group can also be configured to perform MIMO operations such as BLAST or perform diversity operations by selecting and activating orthogonally polarized antennas from the antenna pairs. In particular, when switch 120 is set to position A and switch 122 is set to position D antennas 102 and 108 are selected and are activated by signals on paths 130 and 132 respectively. The signals can be distinct signals that are to be transmitted or are being received using a BLAST code reuse technique or any other MIMO technique. The signals can also be distinct both being received or both being transmitted in a diversity operation. The signals being transmitted and/or received are uncorrelated to each other. Another example is where antenna 102 is receiving a signal while antenna 108 is transmitting another signal or vice versa and both signals fall within the same range of frequencies. Note also that MIMO and diversity operations can also be achieved when antennas 104 and 106 are selected and activated by setting switch 120 to position B and switch 122 to position C. Therefore, selecting orthogonally polarized antennas from a group of antennas allows the selected antennas to perform MIMO operations or diversity operations when activated. [0031] Referring now to the second of group (103) of antennas comprising orthogonally polarized antenna pairs 112, 114 and 116,118 each of which comprises three antenna elements (i.e., 122 a-c, 114 a-c, 116 a-c and 118 a-c). All of the antennas in the second group are located within radome 110. The second group (103) is positioned with respect to the first group such signals from any antenna in the second group is uncorrelated with any signals f rom any antenna in the first group. **Accordingly, the second group of antennas is preferably located a distance of at least 10λ from the first group.** In other words, any antenna in the first group is positioned at a distance of

at least 10λ from any antenna in the second group. In this manner, the first group can perform beam forming/steering while the second group performs MIMO (or diversity) operations or vice versa. Alternatively, both groups can perform MIMO operations or beam forming/steering operations or both groups can perform diversity operations. **It will be readily understood by one skilled in this art that the distance between antenna groups is not limited to 10λ ; other distances (e.g., 5λ , 6λ , 15λ) may be used to achieve de-correlation between signals from the different groups based on propagation environment.** Therefore, the antenna array of the present invention is not limited to an array in which the antenna groups are located at a distance of 10λ from each other.”); claim 3;

Adams US20090322608A1 (cited in prosecution history for claims 4, 5). See 0073 (“As a result, the antenna array 7 a . . . 7 c to which the antenna ports 9 a . . . 9 c are connected is excited as follows: the phase on signals on the first 7 a, second 7 b and third 7 c antenna elements respectively is -90 , 0 , $+90$ degrees and the amplitude is 0.5 , 0.707 , 0.5 respectively. If the antenna elements 7 a . . . 7 c are half a wavelength apart in the azimuth plane at the frequency of operation of the antennas, then the excitation of the antenna elements results in a beam at -30 degrees from boresight (that is, closer in angle to the line from the centre of the array to the first element than to the line from the centre of the array to the third element), where boresight is an angle perpendicular in azimuth to the array 7 a . . . 7 c. On receive, signals will be received from a similar beam.”); 0076; 0085.

Agee ‘841: 12:47-60 (“Raleigh has also shown that this capacity of a MIMO PTP link increases nearly linearly with the number of antennas employed at each end of the link, if the number of propagation paths is greater than or equal to the number of antennas at each end of the link, the pathloss over each path is nearly equal, and either (1) the spatial separation between paths

is large in some sense (e.g., the propagation occurs over paths that impinge on the link transceivers at angles of transmission and reception that are greater than $1/10$ the “beamwidth of the array”), (2) **the antenna elements are separated widely enough to provide statistically independent channel response on each MIMO path (e.g., if the antennas are separated by greater than 10 times the wavelength of the transmission frequency in Rayleigh fading channels).**”); 15:53-55 (“the 10-wavelength rule-of-thumb for statistically independent MIMO propagation path”); 21:54-57 (“to vary different multipath interference amongst the group. A separation of nominally ten wavelengths is generally needed to observe independent signal fading.” Quoting USP 6,128,276); 69:32-39 (“The present state of the art considers 10 wavelengths to be the rule of thumb for the distance between antennas that provides spatially independent antenna feeds due to disparate multipath at each antenna. This rule has greatest applicability in worst-case mobile environments subject to Rayleigh fading, i.e., where the (typically much stronger) direct path is obscured, and propagation occurs over many equal-power reflection paths.”).

Forenza, USP 8,654,815. 2:56-3:4 (“Different MU-MIMO schemes have been proposed as part of the LTE standard [1-3], but they can provide only up to $2\times$ improvement in DL data rate with four transmit antennas. Practical implementations of MU-MIMO techniques in standard and proprietary cellular systems by companies like ArrayComm [4] have yielded up to a $\sim 3\times$ increase (with four transmit antennas) in DL data rate via space division multiple access (SDMA). A key limitation of MU-MIMO schemes in cellular networks is lack of spatial diversity at the transmit side. Spatial diversity is a function of antenna spacing and multipath angular spread in the wireless links. **In cellular systems employing MU-MIMO techniques, transmit antennas at a base station are typically clustered together and placed only one or two wavelengths apart due to limited real estate on antenna support structures**”);

Engstrom, US20090010356. (“[0006] Generally, a MIMO system utilizes de-correlated, or at least essentially de-correlated, transmitted signals. The meaning of the term “de-correlated signals” in this context is that the radiation patterns are essentially de-correlated. This is today made possible by means of spatial separation, i.e. having at least two antennas separated by 5-10 wavelengths, (calculated from the centre frequency of the frequency band for which the antennas are designed), normally in azimuth, in order to achieve low correlation between the signals at the antenna ports. These at least two antennas have at least one antenna radiation lobe each. [0007] It is also possible to combine spatial separation with polarization separation, where the antennas then also are arranged for transmission and reception of signals having orthogonal polarizations. [0008] A base station in a MIMO system may thus be arranged with a number of antennas, separated by 5-10 wavelengths, each one of the base station antennas either being designed for one polarization or a plurality of essentially de-correlated polarizations, typically two essentially de-correlated polarizations. These antennas produce antenna radiation lobes which are de-correlated, either by space or polarization, or both.”); [0033] (“As shown in FIG. 1 *a*, a communication system C comprises a base station 1 arranged for communication in a MIMO (Multiple Input Multiple Output) system. The base station 1 is placed in such a way that it covers a communication cell 2. With reference also to FIG. 1 *b*, the base station 1 is equipped with an array antenna 3, which array antenna 3 in a first embodiment comprises a first 4, second 5, third 6 and fourth 7 antenna element. Each antenna element 4, 5, 6, 7 comprises at least one radiating element. The antenna elements 4, 5, 6, 7 are placed in a first 8 and second 9 row and a first 10 and second column 11, forming a 2×2 array antenna 3. **The antenna elements 4, 5, 6, 7 are preferably mutually separated by approximately 0.5-1 wavelengths (calculated from the centre frequency of the frequency band for which the antennas are designed) in a horizontal plane for beam-forming**

in azimuth and approximately **0.5-4 wavelengths in a vertical plane for beam-forming in elevation.**); 0068.

Crilly ‘231, USP 6,611,231. 10:30-43 (“For example, a separation of about 20 wavelengths may be provided between antenna arrays. The routing devices can allow a higher percentage of receive time using one of the antenna arrays, and also provide the potential of simultaneous transmit streams from the same approximate site. In certain implementations, Multiple Input Multiple Output (MIMO), mesh forwarding and transmit/receive antenna separation may all be provided simultaneously. Moreover, transmit and receive may be swapped for improved diversity reception. Thus, MIMO, mesh forwarding, simultaneous transmit/receive using TDD and spatial diversity may be implemented.”)

Kim, USP 8,204,151. 1:33-60 (“A multiple input multiple output (MIMO) communications system is a system that can transmit and receive data between at least one base station and at least one subscriber station. Since each base station and each subscriber station includes a plurality of antennas, the MIMO scheme makes it possible to improve the efficiency of transmitting and receiving data. A codebook based pre-coding MIMO can provide significant spectral efficiency gain in the downlink closed-loop MIMO. In the IEEE 802.16e and 3GPP LTE standards, a four transmitter (4 TX) antenna limited feedback based closed-loop MIMO configuration is supported. In IEEE 802.16m and 3GPP LTE Advanced standards, in order to provide peak spectral efficiency, an eight transmitter (8 TX) antenna configuration is proposed as a prominent preceding closed loop MIMO downlink system. There are several requirements for a codebook. The codebook is designed based on the complexity and the performance for the 4 TX single-user MIMO (SU-MIMO). The basic assumption of the codebook design was for uncorrelated channel. In the real communication environment, the uncorrelated

channel implies that the antennas are spaced at least a half wavelength (0.5λ) at the subscriber station and **the antennas are spaced at least ten wavelengths (10λ) at the base station**. Given the whole array dimension (usually we assume 10 wavelengths), each transmit antenna is likely to be correlated. Thus, the baseline of the codebook design often is for correlated array.”); 7:54-55 (“the antennas are spaced at least ten wavelengths (10) at the base station”);

USP 7,565,143, Takeuchi. 7:7-20 (“This first embodiment of the invention uses 2-input, 2-output MIMO wireless transmission. In order to maximize the transmission capacity in this system, the correlation between multipath fading on the two wireless transmission paths must be minimized. The size of the seat cushion 33AA1 varies according to the ticket class, but is typically approximately 500 mm square with approximately 700 mm between diagonally opposite corners. In the 5-GHz frequency band, **the distance between antennae 18AA and 19AA is thus greater than approximately 10 times the wavelength, and antenna correlation is sufficiently low**. The predetermined distance between the antennae 25A and 26A is also greater than or equal to the distance between antennae 18AA and 19AA.”)

USP 8,134,504 Xu. 1:29-2:5 (“The key technology of the smart antenna is the beamforming, which changes the directional diagram of an antenna array according to a steering vector of a signal and generates a spatially directional beam, thereby attaining the object of extracting a target signal and suppressing or eliminating interference. **Because a smart antenna system performs the signal processing mainly depending on the strong dependency between antenna array elements to realize the beamforming, the space between the antenna array elements is required to be small; at present, the space is set as $\frac{1}{2}$ wavelength in the TD-SCDMA systems**. FIG. 11 is a schematic diagram of a smart antenna array in a TD-SCDMA system, where all the array elements of the smart antenna (it is hypothesized that there are N array

elements, where N is a positive integer) employ the same polarization mode—vertical polarization, the space between each antenna array element is $\frac{1}{2}$ wavelength, and N antenna array elements act on the beams coming from each direction to carry out the spatial filtering, thus aiming narrow beams with a high gain at the direction of a service user, and aiming null at the direction of the interference, so as to increase the output signal-to-interference ratio of the array, lower the interference in the system, and improve the anti-interference capability of the system. **In an Multiple-Input Multiple-Output (MIMO)** or an Multiple-Input Single-Output (MISO), multiple antennas are used to suppress the channel fading or to increase the system capacity, so that multiplexing gain and space diversity gain may be provided to the system, where the spatial multiplexing technology may greatly increase the channel capacity, while the space diversity technology may increase the channel reliability and lower the channel bit error rate, thus it is regarded as the key technology of the physical layer in the systems such as a Long Term Evolution (LTE) and a WiMax. Because an MIMO/MISO system obtains the diversity gain mainly by using the independence of the space channel fading features of the different antennas, the space between the antenna array elements is required to be large, and theoretically, the space between the antenna array elements is required to be about 10 wavelengths. Because different requirements are laid on the antenna dependency in a smart antenna system and an MIMO/MISO system, the large-scale reconstruction and modification of the antenna system may be faced during the future system evolution process. To solve this problem, and to integrate the smart antenna system and the MIMO/MISO system, in the prior art, either all of the antenna array elements in the original smart antenna system are simply divided into two groups, or the remote end antenna array elements are selected as the transmitting antennas in the specific situations.”); See Fig. 2, 10:39-55 (“FIG. 2 is a schematic diagram of an antenna array according to Embodiment 1 of the invention. As

directed to N array elements in a smart antenna array of a prior art TD-SCDMA system, where N is a positive integer and the **space between each antenna array element is less than or equal to $\lambda/2$ (λ , represents the wavelength)**, this embodiment proposes a technical solution of forming two broad-sense transmitting antennas on the basis of a bipolarized antenna. Specifically, in this embodiment, N array elements in the antenna array are equally divided into two groups: the first antenna array A13 and the second antenna array A23; where each antenna array has N/2 antenna array elements, and **the space between adjacent antenna array elements in each antenna array is less than or equal to $\lambda/2$** , all the antenna array elements in each antenna array employ the same polarization mode, but the polarization modes of the first antenna array A13 and the second antenna array A23 are orthogonal to each other"); See Fig. 7; 16:31-56 ("FIG. 7 is a schematic diagram of an antenna array according to Embodiment 2 of the invention. As directed to N array elements in a smart antenna array of a prior art TD-SCDMA system, where N is a positive integer and **the space between each antenna array element is less than or equal to $\lambda/2$** , this embodiment proposes a technical solution of forming two broad-sense transmitting antennas on the basis of a bipolarized antenna. Specifically, in this embodiment, N array elements in the antenna array are equally divided into two groups: the first antenna array B13 and the second antenna array B23, where each antenna array has N/2 antenna array elements, and **the space between adjacent antenna array elements in each antenna array is less than or equal to $\lambda/2$ (λ , represents the wavelength)**, all the antenna array elements in each antenna array employ the same polarization mode, but the polarization modes of the first antenna array B13 and the second antenna array B23 are orthogonal to each other. For example, the first antenna array B13 may be a -45° polarized antenna array, and the second antenna array B23 may be a $+45^\circ$ polarized antenna array. Thereby, the -45° polarized antenna array and the $+45^\circ$ polarized antenna array form a bipolarized antenna,

and two broad-sense transmitting antennas are formed based on the bipolarized antenna; moreover, these two broad-sense antennas are independent from each other, thus they have an MIMO form.”); claim 3.

Zhang USP 8,879,470. 1:14-30 (“The concept of BF (Beam Forming) derives from smart antenna (SA). The basic principle of SA is that forming a directional beam via process at transmitter using the correlation of channel impulse response of half wavelength-distance antennas array to increase the signal-to-noise ratio (SNR) at receiver and extend coverage area of system. Traditional BF is usually acting on single signal stream, that is, the transmit signal is multiplied with a weight factor and then is transmitted via a plurality of antennas. Normally such gain is called as array gain. Then, the detailed meanings of BF extends with the continuous deeper research of multiple-input and multiple-output (MIMO) system, in which distance of antennas is not limited to half wavelength but may be 4 wavelength/10 wavelength, etc. In these cases, the correlation of channel matrix will weaken largely, and this non-correlation may bring diversity gain, the normal method is STBC (Space Time Block Code); this non-correlation may also bring multiplexing gain, the normal method is v-blast. In this sense, BF has the same meaning as precoding of MIMO, in other words, such BF may be seen as an implementing manner of precoding.”)

Hui, USP 8,442,449 Hui. 5:39-60 (“In the case, where the transmitter 212 has multiple clusters of closely spaced antennas, such as cross-polarized antennas, then the overall transmit covariance matrix Φ_{TX} will have a block diagonal structure with the component transmit covariance matrices of individual antenna clusters as diagonal blocks, i.e.:...where $\{\Phi_{TX,n}\}_{n=1}^{N_c}$ denotes the transmit channel covariance matrix of each individual cluster of antenna elements, and N_c denotes the number of antenna clusters. FIG. 3 shows the **transmitter 212 which has an example of a**

clustered antenna configuration with two antenna clusters 302 and 304 that are physically separated by 10 wavelengths and each antenna cluster 302 and 304 has four closely spaced antennas 306 that have 0.5 wavelength spacing therebetween.”);

Kitchener 515, USP 6,870,515. 10:36-51 (“As mentioned above with reference to FIG. 2, multi-beam antenna systems require closely spaced antenna elements, for example which have a spacing of one half a wavelength. FIG. 15A shows an example of a basestation antenna array 150 with such closely spaced antenna elements 151. In this case each antenna element is a column of six polarised antenna elements. Six such columns are used with a spacing of half a wavelength in azimuth.”)

3GPP TR 36.912 v. 9.3.0 (2010-06). See Annex A, Section A.1 General Assumption (specifying MIMO beamforming downlink transmission with the following antenna configuration at the base station):

Antenna configuration base station	<p>Baseline: 4 or 8 Tx antennas with the following configurations:</p> <p>A) Uncorrelated co-polarized: Co-polarized antennas separated 4 wavelengths (illustration for 4 Tx:)</p> <p>B) Grouped co-polarized: Two groups of co-polarized antennas. 10 wavelengths between center of each group. 0.5 wavelength separation within each group (illustration for 4 Tx:)</p> <p>C) Correlated: co-polarized: 0.5 wavelengths between antennas (illustration for 4 Tx:)</p> <p>D) Uncorrelated cross-polarized: Columns with +-45deg linearly polarized antennas Columns separated 4 wavelengths (illustration for 4 Tx: X X)</p> <p>E) Correlated cross-polarized Columns with +-45deg linearly polarized antennas Columns separated 0.5 wavelengths (illustration for 8Tx: XXXX)</p>
------------------------------------	---

3GPP TR 36.912 v. 2.0.0 (2009-08). See Annex A, Section A.1 General Assumption (specifying MIMO beamforming downlink transmission with the following antenna configuration at the base station):

Antenna configuration base station	<p>Baseline: 4 or 8 Tx antennas with the following configurations:</p> <p>F) Uncorrelated co-polarized: Co-polarized antennas separated 4 wavelengths (illustration for 4 Tx:)</p> <p>G) Grouped co-polarized: Two groups of co-polarized antennas. 10 wavelengths between center of each group. 0.5 wavelength separation within each group (illustration for 4 Tx:)</p> <p>H) Correlated: co-polarized: 0.5 wavelengths between antennas (illustration for 4 Tx:)</p> <p>I) Uncorrelated cross-polarized: Columns with +-45deg linearly polarized antennas Columns separated 4 wavelengths (illustration for 4 Tx: X X)</p> <p>J) Correlated cross-polarized Columns with +-45deg linearly polarized antennas Columns separated 0.5 wavelengths (illustration for 8Tx: XXXX)</p>
------------------------------------	--

e. **'369 Patent**

In the following discussion, the claim elements refer to the elements as charted in the charts for Exhibits E (e.g., E-01). In the asserted combinations between two or more references that are charted in the Exhibit E charts, the combination would be to use the citations for one of the elements (as shown in the charts) from the reference(s) to fill in the gaps for the other reference(s). For example, if XR alleges that element 1[c] is not present in chart E-01, the combination of E-01 and E-02 would include the content of E-02 for element 1[c].

Channel Estimation. Elements 1[a] and 1[b] recite steps of estimating the downlink (forward path) channel based upon the uplink (reverse path) channel signal. Such techniques were well-known prior to the priority date of the '369 patent. The Channel Estimation references include Li 748 (see E-01 chart at elements 1[p], 1[a], 1[b]), Li 827 (see E-02 chart at elements 1[p], 1[a], 1[b]); Agee 923 (see E-04 chart at elements 1[p], 1[a], 1[b]); Minn (see E-05 chart at elements 1[p], 1[a], 1[b]); Yeh (see E-07 chart at elements 1[p], 1[a], 1[b]); Yamamoto (see E-08 chart at elements 1[p], 1[a], 1[b]); Lehne (see E-06 chart at elements 1[p], 1[a], 1[b]); and Keller (see E-11 chart at elements 1[p], 1[a], 1[b]).

The motivation to combine with each of these references (beyond the other motivations identified herein) includes several factors including: (1) the express statements regarding the benefits of channel estimation to adapt the downlink channel for better transmissions in the references themselves (including the specific benefits of various approaches identified in the references); and (2) the knowledge of a POSITA recognizing that channel estimation and adaptation of the downlink transmission based on that channel estimation provided benefits such as better and more reliable transmissions.

OFDM Tone Modification. Element 1[c] recites steps of using the estimation of the downlink (forward path) channel based upon the uplink (reverse path) channel signal to modify transmission power levels for OFDM tones in the forward/downlink path. Such techniques were well-known prior to the priority date of the '369 patent. The OFDM Tone Modification references include Li 748 (see E-01 chart at elements 1[p], 1[c]), Li 827 (see E-02 chart at elements 1[p], 1[c]), Agee 923 (see E-04 chart at elements 1[p], 1[c]), Wong (see E-03 chart at elements 1[p], 1[c]), Yamamoto (see E-08 chart at elements 1[p], 1[c]); Kannan '375 (see Abstract, Figure 9, 2:37-3:47, 7:47-8:21, 14:50-15:10, 24:41-26:12); Onggosanusi 378 (see Abstract, Figs 3, 7, 12-15, 3:10-13, 4:18-20, 5:1-36, 15:52-16:67, 17:25-18:62, 22:10-42, claims 14-21, 27); Raleigh 171 (see Figure 4, 17:42-53 ("It may also be preferable to use coding techniques to leverage strong subchannels to assist in the use of weaker subchannels. It may also be preferable to allocate either bits or transmit power among the subchannels to maximize the amount of information communicated"); 23:60-27("modifies the bit and power loading for each subchannel according to its quality" in an OFDM system to avoid multipath); Fig. 22); and Keller (see Exhibit E-11 at chart at elements 1[p], 1[c]).

The motivation to combine with each of these references (beyond the other motivations identified herein) includes several factors including: (1) the express statements regarding the benefits of adapting the downlink channel by modifying the power levels for various OFDM tones for better downlink transmissions in the references themselves (including the specific benefits of various approaches identified in the references); and (2) the knowledge of a POSITA recognizing that adaptation of the downlink transmission based on that channel estimation by modifying OFDM tone power levels provided benefits such as better and more reliable transmissions.

QPSK Usage. Claims 4, 5, and 7 recites steps of using a specific modulation technique of either OFDM or QPSK. Such modulation techniques were well-known prior to the priority date of the '369 patent. The QPSK Usage references include Li 748 (see E-01 chart at elements 4, 5, 7); Li 827 (see E-02 chart at elements 4, 5, 7); Agee 923 (see E-04 chart at elements 4, 5, 7); Yamamoto (see E-08 chart at elements 4, 5, 7); Keller (see E-11 chart at elements 4, 5, 7). Furthermore, references such as the Holma and Yang references (discussed in Chart E-02 for elements 4, 5, 7) teach that certain known transmission protocols (such as IS-95 and WCDMA) specify the use of either QPSK or OFDM on the uplink or downlink and thus a particular reference's citation to those transmission protocols results in a POSITA understanding that the reference teaches the use of QPSK or OFDM to a POSITA.

The motivation to combine with each of these references (beyond the other motivations identified herein) includes several factors including: (1) that these modulation techniques were two of a small subset of known and widely used modulation techniques for wireless transmission (including the specific benefits of various approaches identified in the references); and (2) the knowledge of a POSITA recognizing that use of such well-known modulation techniques (out of a small subset of known and widely used techniques) was merely a design choice that could

provide benefits such as better and more reliable transmissions based on the knowledge of the benefits of those techniques as well as a desire for compatibility with other widely known and used systems that used such modulation techniques.

Training Data. Claims 9 and 10 recite steps of using identifiable training data in the process of performing the channel estimations recited in elements 1[a] and 1[b]. Such techniques were well-known prior to the priority date of the '369 patent. Indeed, the process of doing channel estimation frequently relies on such identifiable training data because, in order to estimate a particular channel, the use of known data sequences to determine how the channel conditions may modify or distort known signals allows the base station to determine the distortion for the channel occurring on the particular path being measured. This was widely known and the '369 patent did not add a single concept or benefit to the art from what was already known. The Training Data references include Li 748 (see E-01 chart at elements 9, 10); Li 827 (see E-02 chart at elements 9, 10); Agee 923 (see E-04 chart at elements 9, 10); Wong (see E-03 chart at elements 9, 10); Yeh (see E-07 chart at elements 9, 10); Minn (see E-05 chart at elements 9, 10); Lehne (see E-06 chart at elements 9, 10); Yamamoto (see E-08 chart at elements 9, 10); and Keller (see E-11 chart at elements 9, 10).

The motivation to combine with each of these references (beyond the other motivations identified herein) includes several factors including: (1) that the concept of using identifiable, known data to determine how a transmission path might distort or alter data transmissions was a known and widely used techniques for wireless transmission (including the specific benefits of various approaches identified in the references) as shown by the fact that virtually every reference discussing channel conditions recites the use of such identifiable data; and (2) the knowledge of a POSITA recognizing that use of such well-known techniques was a design choice that could

provide benefits such as better and more reliable transmissions based on the knowledge of the conditions on the path being measured by measuring a changed data (the transmitted data) against known data (the known identifiable data).

Antenna Arrays. Claims 15, 19, 21, 28, 23, 33, 35, 36, and 37 recite the usage of various different types of antennas (such as a plurality of antennas, array antennas or beamforming antennas) in the uplink and/or downlink. Such techniques were well-known prior to the priority date of the '369 patent. The '369 patent did not disclose any new teachings regarding the usage of such different antenna arrangement and techniques and did not add any new knowledge to the start of the art in this area. Rather, the '369 patent merely recited the usage of well-known techniques and relied upon the knowledge of a POSITA for the ability to implement those known techniques. Such knowledge is equally available to a POSITA to assess obviousness. Moreover, the knowledge of such antenna technologies was widely known and described in many references. The Antenna Arrays references included Lehne (see E-06 at claims 5, 19, 21, 28, 23, 33, 35, 36, and 37); Agee 923 (see E-06 at claims 5, 19, 21, 28, 23, 33, 35, 36, and 37); Litva (see E-09 at claims 5, 19, 21, 28, 23, 33, 35, 36, and 37); and Keller (see E-11 chart at claims 5, 19, 21, 28, 23, 33, 35, 36, and 37).

The motivation to combine with each of these references (beyond the other motivations identified herein) includes several factors including: (1) that the concept of new antenna techniques such as “smart antennas” or “beam forming” to improve data transmissions was a known and widely used techniques for wireless transmission (including the specific benefits of various approaches identified in the references) as shown by the discussions in both Lehne and Agee 923 regarding the benefits of such techniques; and (2) the knowledge of a POSITA recognizing that use of such well-known techniques was a design choice that could provide benefits such as better

and more reliable transmissions by using techniques that had been developed to improve the specific physical transmission characteristics of wireless signals transmitted in wireless networks.

f. Exemplary Combinations for '235 Patent

As explained above, Defendants contend that a person of ordinary skill in the art would have been motivated to combine with a reasonable expectation of success any of the primary references in these Invalidity Contentions with (1) any other primary reference charted in the charts for A-01 *et seq.*; (2) any reference disclosed in in the section above for specific concepts claimed in the patent; (3) any statements made in the intrinsic record of the patent, and/or (4) the knowledge of one of ordinary skill in the art. By way of example only, Defendants provide the following exemplary combinations and some of the reasons a person of ordinary skill in the art would be motivated to combine references.

Each of the charted references in A-01 *et seq.* are a single reference obviousness reference in light of the knowledge of a POSITA.

As noted above, each of the primary references in charts A-01 *et seq.* can be combined with one of the other charted reference. Additionally, each of the primary references in charts D01 *et seq.* can be combined with one of the other charted references and one of the Beamforming references for the reasons cited in the Beamforming discussion including that, for example, the Beamforming elements were pervasively already known to a POSITA with the '235 patent adding nothing to the art with respect to the Beamforming claim elements.

Furthermore, to the extent that it is determined that any of the above references do not disclose an antenna, or an antenna wherein the antenna comprises a first antenna element and a second antenna element, it would further have been obvious to modify the teachings of that reference to include such an antenna and antenna elements in view of the teachings of at least Agee 841, Walton 040, Derryberry, Crilly, Foschini, Scherzer 647, Xu, Gerlach 1993, Raghothaman,

Jitsukawa, Kim 381, Kim 723, Ottersten, Katz, Hottinen 818, Saunders 877, Youssefmir 567, Hottinen 286, Cyzs, Levy 643, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, Paulraj 290, Kuwahara, Alamouti, and/or Agee 923, which teach an antenna, and further teach wherein the antenna comprises a first antenna element and a second antenna element.

Additionally, to the extent that it is determined that any of the above references do not disclose a transceiver operatively coupled to the antenna and configured to transmit and receive electromagnetic signals using the antenna, it would further have been obvious to modify the teachings of that reference to include such a transceiver in view of the teachings of at least Agee 841, Walton 040, Derryberry, Crilly, Lindskog, Xu, Raghothaman, Kim 381, Kim 723, Ottersten, Katz, Youssefmir 567, Harrison, Hottinen 286, Jang, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, Paulraj 290, Kuwahara, Agee 923, and/or Alamouti, which teach a transceiver operatively coupled to the antenna and configured to transmit and receive electromagnetic signals using the antenna.

Additionally, to the extent that it is determined that any of the above references do not disclose a processor operatively coupled to the transceiver, it would further have been obvious to modify the teachings of that reference to include such a processor in view of the teachings of at least Agee 841, Walton 040, Derryberry, Crilly, Lindskog, Scherzer 258, Raghothaman, Jitsukawa, Kim 723, Ottersten, Katz, Youssefmir 567, Cyzs, Levy 643, Harrison, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, Agee 923, and/or Paulraj 290, which teach a processor operatively coupled to the transceiver.

Additionally, to the extent that it is determined that any of the above references do not disclose a processor configured to receive a first signal transmission from a remote station via the first antenna element and a second signal transmission from the remote station via the second

antenna element simultaneously, it would further have been obvious to modify the teachings of that reference to include a processor with such a configuration in view of the teachings of at least Agee 841, Walton 040, Derryberry, Crilly, Lindskog, Xu, Raghothaman, Gerlach 1993; Kim 381, Ottersten, Kim 723, Ottersten, Katz, Hottinen 818, Saunders 877, Youssefmir 567, Cyzs, Levy 643, Hottinen 286, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, Paulraj 290, Kuwahara, Agee 923, and/or Alamouti, which teach a processor configured to receive a first signal transmission from a remote station via the first antenna element and a second signal transmission from the remote station via the second antenna element simultaneously.

Additionally, to the extent that it is determined that any of the above references do not disclose a processor configured to determine first signal information for the first signal transmission or to determine second signal information for the second signal transmission, wherein the second signal information is different than the first signal information, it would further have been obvious to modify the teachings of that reference to include a processor with such a configuration in view of the teachings of at least Agee 841, Walton 040, Derryberry, Crilly, Lindskog, Scherzer 258, Xu, Raghothaman, Gerlach 1993, Kim 723, Ottersten, Katz, Hottinen 818, Saunders 877, Viswanath, Youssefmir 567, Cyzs, Levy 643, Hottinen 286, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, Paulraj 290, Agee 923, and/or Alamouti, which teach a processor configured to determine first signal information for the first signal transmission and to determine second signal information for the second signal transmission, wherein the second signal information is different than the first signal information.

Additionally, to the extent that it is determined that any of the above references do not disclose a processor configured to cause the transceiver to transmit a third signal to the remote station via the antenna, the third signal comprising content based on the set of weighting values, it

would further have been obvious to modify the teachings of that reference to include a processor with such a configuration in view of the teachings of at least Agee 841, Walton 040, Derryberry, Crilly, Foschini, Lindskog, Raghothaman, Gerlach 1993, Jitsukawa, Kim 381, Kim 723, Ottersten, Katz, Youssefmir 567, Harrison, Cyzs, Hottinen 286, Jang, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, Paulraj 290, Kuwahara, Agee 923, and/or Alamouti, which teach a processor configured to cause the transceiver to transmit a third signal to the remote station via the antenna, the third signal comprising content based on the set of weighting values.

Additionally, to the extent that it is determined that any of the above references do not disclose that the first signal transmission and the second signal transmission comprise electromagnetic signals comprising one or more transmission peaks and one or more transmission nulls, it would further have been obvious to modify the teachings of that reference to include such electromagnetic signals in view of the teachings of at least Agee 841, Walton 040, Derryberry, Crilly, Lindskog, Scherzer 258, Xu, Raghomathan, Gerlach 1993, Kim 381, Ottersten, Katz, Youssefmir 567, Cyzs, Levy 643, Hottinen 286, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, Agee 923, and/or Paulraj 290, which teach that the first signal transmission and the second signal transmission comprise electromagnetic signals comprising one or more transmission peaks and one or more transmission nulls.

Additionally, to the extent that it is determined that any of the above references do not disclose that the content comprises data configured to be used by the remote station to modify the placement of one or more transmission peaks and one or more transmission nulls in a subsequent signal transmission, it would further have been obvious to modify the teachings of that reference to include data in such a configuration in view of the teachings of at least Agee 841, Walton 040, Derryberry, Crilly, Lindskog, Gerlach '199, Scherzer 258, Scherzer 647, Xu, Raghothaman,

Gerlach 1993, Kim 723, Ottersten, Katz, Youssefmir 567, Cyzs, Levy 643, Hottinen 286, Jang, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, Agee 923, and/or Paulraj 290, which teach that the content comprises data configured to be used by the remote station to modify the placement of one or more transmission peaks and one or more transmission nulls in a subsequent signal transmission. Additionally, to the extent that it is determined that any of the above references do not disclose that the set of weighting values is further based on one or more of: a transmit power level, a data transmit rate, an antenna direction, quality of service data, or timing data, it would further have been obvious to modify the teachings of that reference to include such a set of weighting values in view of the teachings of at least Agee 841, Walton 040, Derryberry, Crilly, Foschini, Lindskog, Raghothaman, Gerlach 1993, Jitsukawa, Kim 723, Ottersten, Katz, Levy 643, Hottinen 286, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, and/or Paulraj 290, which teach that the set of weighting values is further based on one or more of: a transmit power level, a data transmit rate, an antenna direction, quality of service data, or timing data.

Additionally, to the extent that it is determined that any of the above references do not disclose a first signal transmission comprising first signal information, wherein the first signal information comprises one or more of: a transmit power level, a data transmit rate, an antenna direction, quality of service data, or timing data, it would further have been obvious to modify the teachings of that reference to include such first signal information in view of the teachings of at least Agee 841, Walton 040, Derryberry, Crilly, Foschini, Lindskog, Scherzer 258, Raghothaman, Gerlach 1993, Jitsukawa, Kim 381, Kim 723, Ottersten, Katz, Levy 643, Hottinen 286, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, and/or Paulraj 290, which teach a first signal transmission comprising first signal information, wherein the first signal information comprises

one or more of: a transmit power level, a data transmit rate, an antenna direction, quality of service data, or timing data.

Without prejudice to any other combinations, Defendants identify specifically the following further combinations (all in light of the knowledge of a POSITA) below.

To the extent Agee 923 does not anticipate and/or render obvious on its own any of the '235 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Agee 923 with any of these references as identified below because each of the references pertains to the same specific subject matter of using beamformed transmissions to effectuate MIMO wireless communications between a base station and a mobile device. The references pertain to the same technology and use the same terminology. Each of the references describes one or more antenna arrays that have multiple individual elements that are used for beamformed transmissions that are shaped by electronic circuits acting as beamformers. The individual beams represent MIMO streams. Those MIMO streams are aggregated by MIMO transceivers (using other terminology including “modems” or baseband units). Thus, a POSITA would be motivated to take beneficial aspects of Agee 923 and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Agee 923 with one of Walton 040, Derryberry, Crilly, Foschini, Scherzer 647, Gerlach 1993, Jitsukawa, Ottersten, Katz, Hottinen 818, Saunders 877, Hottinen 286, Cyzs, Levy 643, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, Paulraj 290, Kuwahara, and/or Alamouti
- Agee 923 with one of the Beamforming references above
- Agee 923 with one of the Channel State Information references above

- Agee 923 with Agee 841 and one of the Channel State Information references above
- Agee 923 with Burke and one of the Channel State Information references above
- Agee 923 with Scherzer 258 and one of the Channel State Information references above
- Agee 923 with Lindskog and one of the Channel State Information references above
- Agee 923 with Raghothaman and one of the Channel State Information references above
- Agee 923 with Gerlach 1993 and one of the Channel State Information references above
- Agee 923 with Viswanath and one of the Channel State Information references above
- Agee 923 with Youssefmir 567 and one of the Channel State Information references above
- Agee 923 with Kim 530 and one of the Channel State Information references above
- Agee 923 with Motorola 3GPP and one of the Channel State Information references above
- Agee 923 with Motorola 3GPP and one of the Channel State Information references above

To the extent Agee 841 does not anticipate and/or render obvious on its own any of the '235 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Agee 841 with any of these references as identified below because each of the references pertains to the same specific subject matter of using beamformed transmissions to effectuate MIMO wireless communications between a base station and a mobile device. The references pertain to the same technology and use the same terminology. Each of the references describes one or more antenna arrays that have multiple individual elements that are used for beamformed transmissions that are shaped by electronic circuits acting as beamformers. The individual beams represent MIMO streams. Those MIMO streams are aggregated by MIMO transceivers (using other terminology including “modems” or

baseband units). Thus, a POSITA would be motivated to take beneficial aspects of Agee 841 and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Agee 841 with one of Walton 040, Derryberry, Crilly, Foschini, Scherzer 647, Gerlach 1993, Jitsukawa, Ottersten, Katz, Hottinen 818, Saunders 877, Hottinen 286, Cyzs, Levy 643, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, Paulraj 290, Kuwahara, and/or Alamouti
- Agee 841 with one of the Beamforming references above
- Agee 841 with one of the Channel State Information references above
- Agee 841 with Agee 923 and one of the Channel State Information references above
- Agee 841 with Burke and one of the Channel State Information references above
- Agee 841 with Scherzer 258 and one of the Channel State Information references above
- Agee 841 with Lindskog and one of the Channel State Information references above
- Agee 841 with Raghothaman and one of the Channel State Information references above
- Agee 841 with Gerlach 1993 and one of the Channel State Information references above
- Agee 841 with Viswanath and one of the Channel State Information references above
- Agee 841 with Youssefmir 567 and one of the Channel State Information references above
- Agee 841 with Kim 530 and one of the Channel State Information references above
- Agee 841 with Motorola 3GPP and one of the Channel State Information references above

To the extent Burke does not anticipate and/or render obvious on its own any of the '235 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Burke with any of these references as identified below because each of the references pertains to the same specific subject matter of

using beamformed transmissions to effectuate MIMO wireless communications between a base station and a mobile device. The references pertain to the same technology and use the same terminology. Each of the references describes one or more antenna arrays that have multiple individual elements that are used for beamformed transmissions that are shaped by electronic circuits acting as beamformers. The individual beams represent MIMO streams. Those MIMO streams are aggregated by MIMO transceivers (using other terminology including “modems” or baseband units). Thus, a POSITA would be motivated to take beneficial aspects of Burke and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Burke with one of Agee 923, Agee 841, Walton 040, Derryberry, Crilly, Foschini, Scherzer 647, Gerlach 1993, Jitsukawa, Ottersten, Katz, Hottinen 818, Saunders 877, Hottinen 286, Cyzs, Levy 643, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, Paulraj 290, Kuwahara, and/or Alamouti
- Burke with one of the Beamforming references above
- Burke with one of the Channel State Information references above
- Burke with Agee 923 and one of the Channel State Information references above
- Burke with Agee 841 and one of the Channel State Information references above
- Burke with Scherzer 258 and one of the Channel State Information references above
- Burke with Lindskog and one of the Channel State Information references above
- Burke with Raghothaman and one of the Channel State Information references above
- Burke with Gerlach 1993 and one of the Channel State Information references above
- Burke with Viswanath and one of the Channel State Information references above
- Burke with Youssefmir 567 and one of the Channel State Information references above
- Burke with Kim 530 and one of the Channel State Information references above
- Burke with Motorola 3GPP and one of the Channel State Information references above
- Burke with Alamouti and one of the Channel State Information references above

To the extent Alamouti does not anticipate and/or render obvious on its own any of the '235 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Alamouti with any of these references as identified below because each of the references pertains to the same specific subject matter of using beamformed transmissions to effectuate MIMO wireless communications between a base station and a mobile device. The references pertain to the same technology and use the same terminology. Each of the references describes one or more antenna arrays that have multiple individual elements that are used for beamformed transmissions that are shaped by electronic circuits acting as beamformers. The individual beams represent MIMO streams. Those MIMO streams are aggregated by MIMO transceivers (using other terminology including “modems” or baseband units). Thus, a POSITA would be motivated to take beneficial aspects of Alamouti and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Alamouti with one of Agee 923, Agee 841, Burke, Walton 040, Derryberry, Crilly, Foschini, Scherzer 647, Gerlach 1993, Jitsukawa, Ottersten, Katz, Hottinen 818, Saunders 877, Hottinen 286, Cyzs, Levy 643, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, Paulraj 290, Kuwahara, and/or Alamouti
- Alamouti with one of the Beamforming references above
- Alamouti with one of the Channel State Information references above
- Alamouti with Agee 923 and one of the Channel State Information references above
- Alamouti with Agee 841 and one of the Channel State Information references above
- Alamouti with Scherzer 258 and one of the Channel State Information references above
- Alamouti with Lindskog and one of the Channel State Information references above

- Alamouti with Raghothaman and one of the Channel State Information references above
- Alamouti with Gerlach 1993 and one of the Channel State Information references above
- Alamouti with Viswanath and one of the Channel State Information references above
- Alamouti with Youssefmir 567 and one of the Channel State Information references above
- Alamouti with Kim 530 and one of the Channel State Information references above
- Alamouti with Motorola 3GPP and one of the Channel State Information references above

To the extent Hottinen 818 does not anticipate and/or render obvious on its own any of the '235 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Hottinen 818 with any of these references as identified below because each of the references pertains to the same specific subject matter of using beamformed transmissions to effectuate MIMO wireless communications between a base station and a mobile device. The references pertain to the same technology and use the same terminology. Each of the references describes one or more antenna arrays that have multiple individual elements that are used for beamformed transmissions that are shaped by electronic circuits acting as beamformers. The individual beams represent MIMO streams. Those MIMO streams are aggregated by MIMO transceivers (using other terminology including “modems” or baseband units). Thus, a POSITA would be motivated to take beneficial aspects of Hottinen 818 and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Hottinen 818 with one of Agee 923, Agee 841, Burke, Walton 040, Derryberry, Crilly, Foschini, Scherzer 647, Gerlach 1993, Jitsukawa, Ottersten, Katz, Saunders 877, Hottinen 286, Cyzs, Levy 643, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, Paulraj 290, Kuwahara, and/or Alamouti
- Hottinen 818 with one of the Beamforming references above
- Hottinen 818 with one of the Channel State Information references above
- Hottinen 818 with Agee 923 and one of the Channel State Information references above
- Hottinen 818 with Agee 841 and one of the Channel State Information references above
- Hottinen 818 with Scherzer 258 and one of the Channel State Information references above
- Hottinen 818 with Lindskog and one of the Channel State Information references above
- Hottinen 818 with Raghothaman and one of the Channel State Information references above
- Hottinen 818 with Gerlach 1993 and one of the Channel State Information references above
- Hottinen 818 with Viswanath and one of the Channel State Information references above
- Hottinen 818 with Youssefmir 567 and one of the Channel State Information references above
- Hottinen 818 with Kim 530 and one of the Channel State Information references above
- Hottinen 818 with Motorola 3GPP and one of the Channel State Information references above

To the extent Hottinen 286 does not anticipate and/or render obvious on its own any of the '235 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Hottinen 286 with any of these references as identified below because each of the references pertains to the same specific subject matter of using beamformed transmissions to effectuate MIMO wireless communications between a base station and a mobile device. The references pertain to the same technology and use the same terminology. Each of the references describes one or more antenna arrays that have multiple individual elements that are used for beamformed transmissions that are shaped by electronic

circuits acting as beamformers. The individual beams represent MIMO streams. Those MIMO streams are aggregated by MIMO transceivers (using other terminology including “modems” or baseband units). Thus, a POSITA would be motivated to take beneficial aspects of Hottinen 286 and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Hottinen 286 with one of Agee 923, Agee 841, Burke, Walton 040, Derryberry, Crilly, Foschini, Scherzer 647, Gerlach 1993, Jitsukawa, Ottersten, Katz, Hottinen 818, Saunders 877, Cyzs, Levy 643, Heath 2001, Gerlach 647, Hottinen 2000, Kim 530, Paulraj 290, Kuwahara, and/or Alamouti
- Hottinen 286 with one of the Beamforming references above
- Hottinen 286 with one of the Channel State Information references above
- Hottinen 286 with Agee 923 and one of the Channel State Information references above
- Hottinen 286 with Agee 841 and one of the Channel State Information references above
- Hottinen 286 with Scherzer 258 and one of the Channel State Information references above
- Hottinen 286 with Lindskog and one of the Channel State Information references above
- Hottinen 286 with Raghothaman and one of the Channel State Information references above
- Hottinen 286 with Gerlach 1993 and one of the Channel State Information references above
- Hottinen 286 with Viswanath and one of the Channel State Information references above
- Hottinen 286 with Youssefmir 567 and one of the Channel State Information references above
- Hottinen 286 with Kim 530 and one of the Channel State Information references above
- Hottinen 286 with Motorola 3GPP and one of the Channel State Information references above
- Hottinen 286 with Saunders 877 and one of the Channel State Information references above

To the extent Hottinen 2000 does not anticipate and/or render obvious on its own any of the '235 claims, a person of ordinary skill in the art would have been motivated to combine it with

one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Hottinen 2000 with any of these references as identified below because each of the references pertains to the same specific subject matter of using beamformed transmissions to effectuate MIMO wireless communications between a base station and a mobile device. The references pertain to the same technology and use the same terminology. Each of the references describes one or more antenna arrays that have multiple individual elements that are used for beamformed transmissions that are shaped by electronic circuits acting as beamformers. The individual beams represent MIMO streams. Those MIMO streams are aggregated by MIMO transceivers (using other terminology including “modems” or baseband units). Thus, a POSITA would be motivated to take beneficial aspects of Hottinen 2000 and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Hottinen 2000 with one of Agee 923, Agee 841, Burke, Walton 040, Derryberry, Crilly, Foschini, Scherzer 647, Gerlach 1993, Jitsukawa, Ottersten, Katz, Hottinen 818, Saunders 877, Cyzs, Levy 643, Heath 2001, Gerlach 647, Hottinen 286, Kim 530, Paulraj 290, Kuwahara, and/or Alamouti
- Hottinen 2000 with one of the Beamforming references above
- Hottinen 2000 with one of the Channel State Information references above
- Hottinen 2000 with Agee 923 and one of the Channel State Information references above
- Hottinen 2000 with Agee 841 and one of the Channel State Information references above
- Hottinen 2000 with Scherzer 258 and one of the Channel State Information references above
- Hottinen 2000 with Lindskog and one of the Channel State Information references above
- Hottinen 2000 with Raghothaman and one of the Channel State Information references above
- Hottinen 2000 with Gerlach 1993 and one of the Channel State Information references above

- Hottinen 2000 with Viswanath and one of the Channel State Information references above
- Hottinen 2000 with Youssefmir 567 and one of the Channel State Information references above
- Hottinen 2000 with Kim 530 and one of the Channel State Information references above
- Hottinen 2000 with Motorola 3GPP and one of the Channel State Information references above

To the extent Saunders 877 does not anticipate and/or render obvious on its own any of the '235 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Saunders 877 with any of these references as identified below because each of the references pertains to the same specific subject matter of using beamformed transmissions to effectuate MIMO wireless communications between a base station and a mobile device. The references pertain to the same technology and use the same terminology. Each of the references describes one or more antenna arrays that have multiple individual elements that are used for beamformed transmissions that are shaped by electronic circuits acting as beamformers. The individual beams represent MIMO streams. Those MIMO streams are aggregated by MIMO transceivers (using other terminology including “modems” or baseband units). Thus, a POSITA would be motivated to take beneficial aspects of Saunders 877 and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Saunders 877 with one of Agee 923, Agee 841, Burke, Walton 040, Derryberry, Crilly, Foschini, Scherzer 647, Gerlach 1993, Jitsukawa, Ottersten, Katz, Hottinen 818, Hottinen 2000, Cyzs, Levy 643, Heath 2001, Gerlach 647, Hottinen 286, Kim 530, Paulraj 290, Kuwahara, and/or Alamouti

- Saunders 877 with one of the Beamforming references above
- Saunders 877 with one of the Channel State Information references above
- Saunders 877 with Agee 923 and one of the Channel State Information references above
- Saunders 877 with Agee 841 and one of the Channel State Information references above
- Saunders 877 with Scherzer 258 and one of the Channel State Information references above
- Saunders 877 with Lindskog and one of the Channel State Information references above
- Saunders 877 with Raghothaman and one of the Channel State Information references above
- Saunders 877 with Gerlach 1993 and one of the Channel State Information references above
- Saunders 877 with Viswanath and one of the Channel State Information references above
- Saunders 877 with Youssefmir 567 and one of the Channel State Information references above
- Saunders 877 with Kim 530 and one of the Channel State Information references above
- Saunders 877 with Motorola 3GPP and one of the Channel State Information references above
- Saunders 877 with Hottinen 286 and one of the Channel State Information references above
- Saunders 877 with Hottinen 818
- Saunders 877 with Hottinen 818 and one of the Channel State Information references above

g. Exemplary Combinations For '939 Patent

As explained above, Defendants contend that a person of ordinary skill in the art would have been motivated to combine with a reasonable expectation of success any of the primary

references in these Invalidity Contentions with (1) any other primary reference charted in the charts for B-01 *et seq.*; (2) any reference disclosed in in the section above for specific concepts claimed in the patent; (3) any statements made in the intrinsic record of the patent, and/or (4) the knowledge of one of ordinary skill in the art. By way of example only, Defendants provide the following exemplary combinations and some of the reasons a person of ordinary skill in the art would be motivated to combine references.

Each of the charted references in B-01 *et seq.* are a single reference obviousness reference in light of the knowledge of a POSITA.

As noted above, each of the primary references in charts B-01 *et seq.* can be combined with one of the other charted reference. Additionally, each of the primary references in charts B-01 *et seq.* can be combined with one of the other charted references and one of the Plurality of Access Points references for the reasons cited in the Plurality of Access Points discussion including that, for example, the Plurality of Access Points elements were pervasively already known to a POSITA with the '939 patent adding nothing to the art with respect to the Plurality of Access Points claim elements. Without prejudice to any other combinations, Defendants identify specifically the following further combinations (all in light of the knowledge of a POSITA) below.

To the extent Kasami 501 does not anticipate and/or render obvious on its own any of the '939 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Kasami 501 with any of these references as identified below because each of the references pertains to the same specific subject matter of restraining one access point from transmitting while another access point is receiving to

coordinate wireless communications between multiple access points and multiple mobile devices. The references pertain to the same technology and use the same terminology. Each of the references describes a plurality of access points and restraining one access point from transmitting on one channel when a different access point is receiving on a second channel. Thus, a POSITA would be motivated to take beneficial aspects of Kasami 501 and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Kasami 501 with one of Hansen, AP-1000, Jaszewski, Parantainen, McHenry, Proctor, Gibbons, Hamalainen, Watanabe, Reudink, and Sashihara
- Kasami 501 with one of the Plurality of Access Points references above
- Kasami 501 with one of the Restraining Transmission references above
- Kasami 501 with AP-1000 and one of the Restraining Transmission references above
- Kasami 501 with Hansen and one of the Restraining Transmission references above
- Kasami 501 with Reudink and one of the Restraining Transmission references above
- Kasami 501 with Jaszewski and one of the Restraining Transmission references above
- Kasami 501 with Parantainen and one of the Restraining Transmission references above
- Kasami 501 with Gibbons and one of the Restraining Transmission references above

To the extent Hansen does not anticipate and/or render obvious on its own any of the '939 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Kasami 501 with any of these references as identified below because each of the references pertains to the same specific subject matter of restraining one access point from transmitting while another access point is receiving to coordinate wireless communications between multiple access points and multiple mobile devices. The references pertain to the same technology and use the same terminology. Each of the references describes a plurality of access points and restraining one access point from transmitting on one channel when a different access point is receiving on a second channel. Thus, a POSITA would be motivated to take beneficial aspects of Hansen and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Hansen with one of Kasami 501, AP-1000, Jaszewski, Parantainen, McHenry, Proctor, Hamalainen, Watanabe, Reudink, and Sashihara
- Hansen with one of the Plurality of Access Points references above
- Hansen with one of the Restraining Transmission references above
- Hansen with AP-1000 and one of the Restraining Transmission references above
- Hansen with Kasami 501 and one of the Restraining Transmission references above
- Hansen with Reudink and one of the Restraining Transmission references above
- Hansen with Parantainen and one of the Restraining Transmission references above
- Hansen with Gibbons and one of the Restraining Transmission references above

To the extent Reudink does not anticipate and/or render obvious on its own any of the '939 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Reudink with any of these references as identified below because each of the references pertains to the same specific subject matter of restraining one access point from transmitting while another access point is receiving to coordinate wireless communications between multiple access points and multiple mobile devices. The references pertain to the same technology and use the same terminology. Each of the references describes a plurality of access points and restraining one access point from transmitting on one channel when a different access point is receiving on a second channel. Thus, a POSITA would be motivated to take beneficial aspects of Reudink and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Reudink with one of Kasami 501, AP-1000, Jaszewski, Parantainen, McHenry, Proctor, Hamalainen, Watanabe, Hansen, and Sashihara
- Reudink with one of the Plurality of Access Points references above
- Reudink with one of the Restraining Transmission references above
- Reudink with AP-1000 and one of the Restraining Transmission references above
- Reudink with Kasami 501 and one of the Restraining Transmission references above
- Reudink with Hansen and one of the Restraining Transmission references above
- Reudink with Parantainen and one of the Restraining Transmission references above
- Reudink with Gibbons and one of the Restraining Transmission references above

To the extent AP-1000 does not anticipate and/or render obvious on its own any of the '939 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine AP-1000 with any of these references as identified below because each of the references pertains to the same specific subject matter of restraining one access point from transmitting while another access point is receiving to coordinate wireless communications between multiple access points and multiple mobile devices. The references pertain to the same technology and use the same terminology. Each of the references describes a plurality of access points and restraining one access point from transmitting on one channel when a different access point is receiving on a second channel. Thus, a POSITA would be motivated to take beneficial aspects of AP-1000 and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- AP-1000 with one of Kasami 501, Reudink, Jaszewski, Parantainen, McHenry, Proctor, Hamalainen, Watanabe, Hansen, and Sashihara
- AP-1000 with one of the Plurality of Access Points references above
- AP-1000 with one of the Restraining Transmission references above
- AP-1000 with Reudink and one of the Restraining Transmission references above
- AP-1000 with Kasami 501 and one of the Restraining Transmission references above
- AP-1000 with Hansen and one of the Restraining Transmission references above
- AP-1000 with Parantainen and one of the Restraining Transmission references above
- AP-1000 with Gibbons and one of the Restraining Transmission references above

To the extent Parantainen does not anticipate and/or render obvious on its own any of the '939 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Parantainen with any of these references as identified below because each of the references pertains to the same specific subject matter of restraining one access point from transmitting while another access point is receiving to coordinate wireless communications between multiple access points and multiple mobile devices. The references pertain to the same technology and use the same terminology. Each of the references describes a plurality of access points and restraining one access point from transmitting on one channel when a different access point is receiving on a second channel. Thus, a POSITA would be motivated to take beneficial aspects of Parantainen and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Parantainen with one of Kasami 501, Reudink, Jaszewski, AP-1000, McHenry, Proctor, Hamalainen, Watanabe, Hansen, and Sashihara
- Parantainen with one of the Plurality of Access Points references above
- Parantainen with one of the Restraining Transmission references above
- Parantainen with Reudink and one of the Restraining Transmission references above
- Parantainen with Kasami 501 and one of the Restraining Transmission references above
- Parantainen with Hansen and one of the Restraining Transmission references above
- Parantainen with AP-1000 and one of the Restraining Transmission references above
- Parantainen with Gibbons and one of the Restraining Transmission references above

To the extent Gibbons does not anticipate and/or render obvious on its own any of the '939 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Gibbons with any of these references as identified below because each of the references pertains to the same specific subject matter of restraining one access point from transmitting while another access point is receiving to coordinate wireless communications between multiple access points and multiple mobile devices. The references pertain to the same technology and use the same terminology. Each of the references describes a plurality of access points and restraining one access point from transmitting on one channel when a different access point is receiving on a second channel. Thus, a POSITA would be motivated to take beneficial aspects of Gibbons and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Gibbons with one of Kasami 501, Reudink, Jaszewski, AP-1000, McHenry, Proctor, Hamalainen, Watanabe, Hansen, Parantainen, and Sashihara
- Gibbons with one of the Plurality of Access Points references above
- Gibbons with one of the Restraining Transmission references above
- Gibbons with Reudink and one of the Restraining Transmission references above
- Gibbons with Kasami 501 and one of the Restraining Transmission references above
- Gibbons with Hansen and one of the Restraining Transmission references above
- Gibbons with AP-1000 and one of the Restraining Transmission references above
- Gibbons with Parantainen and one of the Restraining Transmission references above

To the extent Heine does not anticipate and/or render obvious on its own any of the '939 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Heine with any of these references as identified below because each of the references pertains to the same specific subject matter of restraining one access point from transmitting while another access point is receiving to coordinate wireless communications between multiple access points and multiple mobile devices. The references pertain to the same technology and use the same terminology. Each of the references describes a plurality of access points and restraining one access point from transmitting on one channel when a different access point is receiving on a second channel. Thus, a POSITA would be motivated to take beneficial aspects of Heine and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations. Moreover, Heine pertains to GSM and Parantainen expressly states that its system is applicable to GSM. Heine and Parantainen are also contemporaneous with each other and disclose highly similar technology.

- Heine with one of Kasami 501, Reudink, Jaszewski, AP-1000, McHenry, Proctor, Hamalainen, Watanabe, Hansen, Parantainen, and Sashihara
- Heine with one of the Plurality of Access Points references above
- Heine with one of the Restraining Transmission references above
- Heine with Reudink and one of the Restraining Transmission references above
- Heine with Kasami 501 and one of the Restraining Transmission references above
- Heine with Hansen and one of the Restraining Transmission references above
- Heine with AP-1000 and one of the Restraining Transmission references above
- Heine with Gibbons and one of the Restraining Transmission references above
- Heine with Parantainen and one of the Restraining Transmission references above.

To the extent Liberti does not anticipate and/or render obvious on its own any of the '939 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Liberti with any of these references as identified below because each of the references pertains to the same specific subject matter of restraining one access point from transmitting while another access point is receiving to coordinate wireless communications between multiple access points and multiple mobile devices. The references pertain to the same technology and use the same terminology. Each of the references describes a plurality of access points and restraining one access point from transmitting on one channel when a different access point is receiving on a second channel. Thus, a POSITA would be motivated to take beneficial aspects of Liberti and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations. Moreover, Liberti pertains to IS-95. Liberti and Parantainen are also contemporaneous with each other and disclose highly similar technology.

- Liberti with one of Kasami 501, Reudink, Jaszewski, AP-1000, McHenry, Proctor, Hamalainen, Watanabe, Hansen, Parantainen, and Sashihara
- Liberti with one of the Plurality of Access Points references above
- Liberti with one of the Restraining Transmission references above
- Liberti with Reudink and one of the Restraining Transmission references above
- Liberti with Kasami 501 and one of the Restraining Transmission references above
- Liberti with Hansen and one of the Restraining Transmission references above
- Liberti with AP-1000 and one of the Restraining Transmission references above

- Liberti with Gibbons and one of the Restraining Transmission references above
- Liberti with Parantainen and one of the Restraining Transmission references above.

h. Exemplary Combinations For '376 Patent

As explained above, Defendants contend that a person of ordinary skill in the art would have been motivated to combine with a reasonable expectation of success any of the primary references in these Invalidity Contentions with (1) any other primary reference charted in the charts for C-01 *et seq.*; (2) any reference disclosed in in the section above for specific concepts claimed in the patent; (3) any statements made in the intrinsic record of the patent, and/or (4) the knowledge of one of ordinary skill in the art. By way of example only, Defendants provide the following exemplary combinations and some of the reasons a person of ordinary skill in the art would be motivated to combine references.

Each of the charted references in C-01 *et seq.* are a single reference obviousness reference in light of the knowledge of a POSITA.

As noted above, each of the primary references in charts C-01 *et seq.* can be combined with one of the other charted reference. Additionally, each of the primary references in charts C-01 *et seq.* can be combined with one of the other charted references and one of the Transmission Peaks and Nulls references for the reasons cited in the Transmission Peaks and Nulls discussion including that, for example, the Transmission Peaks and Nulls elements were pervasively already known to a POSITA with the '376 patent adding nothing to the art with respect to the Transmission Peaks and Nulls claim elements.

Furthermore, to the extent that it is determined that any of the above references do not disclose a processor, it would further have been obvious to modify the teachings of that reference to include such a processor in view of the teachings of at least Kanamaluru, Katz, Lewis, Kasami 501, Gurelli, Gerlach 647, Gerlach 199, Crilly, Carloni, Sayers, Kasami 430, Lindskog,

Youssefmir, Agee 923, Reudink, Barratt, Gerlach-AT, Gerlach Thesis, Godara, Rashid-Farrokhi, Hovers, Vook, Lehne, and Litva, which teach an antenna, and further teach wherein the antenna comprises a first antenna element and a second antenna element.

Additionally, to the extent that it is determined that any of the above references do not disclose a processor configured to generate a probing signal for transmission to at least a first client device and a second client device, it would further have been obvious to modify the teachings of that reference to include such a transceiver in view of the teachings of at least Kanamaluru, Katz, Lewis, Kasami 501, Gurelli, Gerlach 647, Gerlach 199, Crilly, Carloni, Sayers, Kasami 430, Lindskog, Youssefmir, Agee 923, Reudink, Barratt, Gerlach-AT, Gerlach Thesis, Godara, Rashid-Farrokhi, Hovers, Vook, Lehne, and Litva, which teach a processor configured to generate a probing signal for transmission to at least a first client device and a second client device

Additionally, to the extent that it is determined that any of the above references do not disclose a transceiver operatively coupled to the processor, it would further have been obvious to modify the teachings of that reference to include such a transceiver in view of the teachings of at least Kanamaluru, Katz, Lewis, Kasami 501, Gurelli, Gerlach 647, Gerlach 199, Crilly, Carloni, Sayers, Kasami 430, Lindskog, Youssefmir, Agee 923, Reudink, Barratt, Gerlach-AT, Gerlach Thesis, Godara, Rashid-Farrokhi, Hovers, Vook, Lehne, and Litva, which teach a transceiver operatively coupled to the processor.

Additionally, to the extent that it is determined that any of the above references do not disclose a transceiver configured to transmit the probing signal to at least the first client device and the second client device, it would further have been obvious to modify the teachings of that reference to include such a processor in view of the teachings of at least Kanamaluru, Katz, Lewis, Kasami 501, Gurelli, Gerlach 647, Gerlach 199, Crilly, Carloni, Sayers, Kasami 430, Lindskog,

Youssefmir, Agee 923, Reudink, Barratt, Gerlach-AT, Gerlach Thesis, Godara, Rashid-Farrokhi, Hovers, Vook, Lehne, and Litva,, which teach a processor operatively coupled to the transceiver.

Without prejudice to any other combinations, Defendants identify specifically the following further combinations (all in light of the knowledge of a POSITA) below.

To the extent Gerlach 647 does not anticipate and/or render obvious on its own any of the '376 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Gerlach 647 with any of these references as identified below because each of the references pertains to the same specific subject matter of using probing signals to solicit feedback information and using feedback information to generate beamformed transmissions to effectuate wireless communications between an access point and a client device. The references pertain to the same technology and use the same terminology. Each of the references describes one or smart antennas and further describes beamforming transmissions to client devices. Thus, a POSITA would be motivated to take beneficial aspects of Gerlach 647 and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Gerlach 647 with one of Gerlach 199, Crilly, Carloni, Sayers, Kasami 430, Linskog, Youssefmir, Gerlach-AT, Gerlach Thesis, Reudink, Hovers, Vook, Lehne, or Litva
- Gerlach 647 with one of the Transmission Peaks and Transmission Nulls references above
- Gerlach with one of the Smart Antennas references above
- Gerlach 647 with Agee 923

- Gerlach 647 with Agee 923 and one of the Transmission Peaks and Transmission Nulls references above
- Gerlach 647 with Kasami 501
- Gerlach 647 with Kasami 647 and one of the Transmission Peaks and Transmission Nulls references above
- Gerlach 647 with Agee 923 and Kasami 501
- Gerlach 647 with Agee 923, Kasami 501, and one of the Transmission Peaks and Transmission Nulls references above
- Gerlach 647 with Vook
- Gerlach 647 with Vook and one of the Transmission Peaks and Transmission Nulls references above
- Gerlach 647 with Barratt
- Gerlach 647 with Barratt and one of the Transmission Peaks and Transmission Nulls references above
- Gerlach 647 with Litva
- Gerlach 647 with Litva and one of the Transmission Peaks and Transmission Nulls references above

To the extent Agee 923 does not anticipate and/or render obvious on its own any of the '376 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Agee 923 with any of these references as identified below because each of the references pertains to the same specific subject matter of using probing signals to solicit feedback information and using feedback information to generate beamformed transmissions to effectuate wireless communications between an access point and a client device. The references pertain to the same technology and use the same terminology. Each of the references describes one or smart antennas and further describes beamforming transmissions

to client devices. Thus, a POSITA would be motivated to take beneficial aspects of Agee 923 and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Agee 923 with one of Gerlach 199, Crilly, Carloni, Sayers, Kasami 430, Lindskog, Youssefmir, Gerlach-AT, Gerlach Thesis, Reudink, Hovers, Vook, Lehne, or Litva
- Agee 923 with one of the Transmission Peaks and Transmission Nulls references above
- Agee 923 with one of the Smart Antennas references above
- Agee 923 with Gerlach 647
- Agee 923 with Gerlach 647 and one of the Transmission Peaks and Transmission Nulls references above
- Agee 923 with Vook
- Agee 923 with Vook and one of the Transmission Peaks and Transmission Nulls references above
- Agee 923 with Kasami 501
- Agee 923 with Kasami 501 and one of the Transmission Peaks and Transmission Nulls references above
- Agee 923 with Gerlach 647 and Kasami 501
- Agee 923 with Gerlach 647, Kasami 501, and one of the Transmission Peaks and Transmission Nulls references above
- Agee 923 with Vook, and Kasami 501
- Agee 923 with Vook, Kasami 501, and one of the Transmission Peaks and Transmission Nulls references above

To the extent Lehne does not anticipate and/or render obvious on its own any of the '376 claims, a person of ordinary skill in the art would have been motivated to combine it with one or

two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Lehne with any of these references as identified below because each of the references pertains to the same specific subject matter of using probing signals to solicit feedback information and using feedback information to generate beamformed transmissions to effectuate wireless communications between an access point and a client device. The references pertain to the same technology and use the same terminology. Each of the references describes one or smart antennas and further describes beamforming transmissions to client devices. Thus, a POSITA would be motivated to take beneficial aspects of Lehne and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Lehne with one of Gerlach 199, Crilly, Carloni, Sayers, Kasami 430, Lindskog, Youssefmir, Gerlach-AT, Gerlach Thesis, Reudink, Hovers, Vook, or Litva
- Lehne with one of the Transmission Peaks and Transmission Nulls references above
- Lehne with one of the Smart Antennas references above
- Lehne with Vook
- Lehne with Vook and one of the Transmission Peaks and Transmission Nulls references above
- Lehne with Kasami 501 and one of the Transmission Peaks and Transmission Nulls references above,
- Lehne with Vook and Kasami 501
- Lehne with Vook, Kasami 501, and one of the Transmission Peaks and Transmission Nulls references above

To the extent Litva does not anticipate and/or render obvious on its own any of the '376 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Litva with any of these references as identified below because each of the references pertains to the same specific subject matter of using probing signals to solicit feedback information and using feedback information to generate beamformed transmissions to effectuate wireless communications between an access point and a client device. The references pertain to the same technology and use the same terminology. Each of the references describes one or smart antennas and further describes beamforming transmissions to client devices. Thus, a POSITA would be motivated to take beneficial aspects of Litva and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Litva with one of Gerlach 199, Crilly, Carloni, Sayers, Kasami 430, Lindskog, Youssefmir, Gerlach-AT, Gerlach Thesis, Reudink, Hovers, Vook, Gerlach 647, Gerlach 199, Agee 923, or Lehne
- Litva with one of the Transmission Peaks and Transmission Nulls references above
- Litva with one of the Smart Antennas references above
- Litva with Vook
- Litva with Vook and one of the Transmission Peaks and Transmission Nulls references above
- Litva with Kasami 501 and one of the Transmission Peaks and Transmission Nulls references above,
- Litva with Vook and Kasami 501

- Litva with Vook, Kasami 501, and one of the Transmission Peaks and Transmission Nulls references above
- Litva with Gerlach 647
- Litva with Gerlach 647 and one of the Transmission Peaks and Transmission Nulls references above
- Litva with Agee 923
- Litva with Agee 923 and one of the Transmission Peaks and Transmission Nulls references above

To the extent Vook does not anticipate and/or render obvious on its own any of the '376 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Vook with any of these references as identified below because each of the references pertains to the same specific subject matter of using probing signals to solicit feedback information and using feedback information to generate beamformed transmissions to effectuate wireless communications between an access point and a client device. The references pertain to the same technology and use the same terminology. Each of the references describes one or smart antennas and further describes beamforming transmissions to client devices. Thus, a POSITA would be motivated to take beneficial aspects of Vook and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Vook with one of Gerlach 199, Crilly, Carloni, Sayers, Kasami 430, Lindskog, Youssefmir, Gerlach-AT, Gerlach Thesis, Reudink, Hovers, , Gerlach 647, Gerlach 199, Agee 923, Lehne, or Litva
- Vook with one of the Transmission Peaks and Transmission Nulls references above

- Vook with one of the Smart Antennas references above
- Vook with Lehne,
- Vook with Lehne and one of the Transmission Peaks and Transmission Nulls references above
- Vook with Agee 923
- Vook with Agee 923 and one of the Transmission Peaks and Transmission Nulls references above
- Vook with Kasami 501
- Vook with Kasami 501 and one of the Transmission Peaks and Transmission Nulls references above
- Vook with Lehne and Kasami 501
- Vook with Lehne, Kasami 501, and one of the Transmission Peaks and Transmission Nulls references above
- Vook with Agee 923 and Kasami 501
- Vook with Agee 923, Kasami 501, and one of the Transmission Peaks and Transmission Nulls references above

To the extent Kasami 501 does not anticipate and/or render obvious on its own any of the '376 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Kasami 501 with any of these references as identified below because each of the references pertains to the same specific subject matter of using probing signals to solicit feedback information and using feedback information to generate beamformed transmissions to effectuate wireless communications between an access point and a client device. The references pertain to the same technology and use the same terminology. Each of the references describes one or smart antennas and further describes

beamforming transmissions to client devices. Thus, a POSITA would be motivated to take beneficial aspects of Kasami 501 and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

- Kasami 501 with one of Gerlach 199, Crilly, Carloni, Sayers, Kasami 430, Linskog, Youssefmir, Gerlach-AT, Gerlach Thesis, Reudink, Hovers, , Gerlach 647, Gerlach 199, Agee 923, Lehne, or Litva
- Kasami 501 with one of the Transmission Peaks and Transmission Nulls references above
- Kasami 501 with one of the Smart Antennas references above
- Kasami 501 with Gerlach 647
- Kasami 501 with Gerlach 647 and one of the Transmission Peaks and Transmission Nulls references above
- Kasami 501 with Agee 923
- Kasami 501 with Agee 923 and one of the Transmission Peaks and Transmission Nulls references above
- Kasami 501 and Lehne
- Kasami 501 with Lehne and one of the Transmission Peaks and Transmission Nulls references above
- Kasami 501 with Vook
- Kasami 501 with Vook and one of the Transmission Peaks and Transmission Nulls references above
- Kasami 501 with Agee 923 and Gerlach 647
- Kasami 501 with Agee 923, Gerlach 647, and one of the Transmission Peaks and Transmission Nulls references above
- Kasami 501 with Vook and Lehne
- Kasami 501 with Vook, Lehne, and one of the Transmission Peaks and Transmission Nulls references above

- Kasami 501 with Agee 923 and Vook
- Kasami 501 with Agee 923, Vook, and one of the Transmission Peaks and Transmission Nulls references above

i. Exemplary Combinations For ‘511 Patent

As explained above, Defendants contend that a person of ordinary skill in the art would have been motivated to combine with a reasonable expectation of success any of the primary references in these Invalidity Contentions with (1) any other primary reference charted in the charts for D01 *et seq.*; (2) any reference disclosed in in the section above for specific concepts claimed in the patent; (3) any statements made in the intrinsic record of the patent, and/or (4) the knowledge of one of ordinary skill in the art. By way of example only, Defendants provide the following exemplary combinations and some of the reasons a person of ordinary skill in the art would be motivated to combine references.

Each of the charted references in D01 *et seq.* are a single reference obviousness reference in light of the knowledge of a POSITA.

As noted above, each of the primary references in charts D01 *et seq.* can be combined with one of the other charted reference. Additionally, each of the primary references in charts D01 *et seq.* can be combined with one of the other charted references and one of the Antenna Spacing references for the reasons cited in the Antenna Spacing discussion including that, for example, the Antenna Spacing elements were pervasively already known to a POSITA with the ‘511 patent adding nothing to the art with respect to the Antenna Spacing claim elements. Without prejudice to any other combinations, Defendants identify specifically the following further combinations (all in light of the knowledge of a POSITA) below.

To the extent Trigui does not anticipate and/or render obvious on its own any of the ‘511 claims, a person of ordinary skill in the art would have been motivated to combine it with one or

two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Trigui with any of these references as identified below because each of the references pertains to the same specific subject matter of using beamformed transmissions to effectuate MIMO wireless communications between a base station and a mobile device. The references pertain to the same technology and use the same terminology. Each of the references describes one or more antenna arrays that have multiple individual elements that are used for beamformed transmissions that are shaped by electronic circuits acting as beamformers. The individual beams represent MIMO streams. Those MIMO streams are aggregated by MIMO transceivers (using other terminology including “modems” or baseband units). Thus, a POSITA would be motivated to take beneficial aspects of Trigui and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

Furthermore, for the references below that were identified specifically on the face of Negus and submitted to the PTO during the prosecution of Negus, a POSITA would be motivated to combine such references with Trigui for the reason that the inventor thought these references so pertinent as to have submitted them to the PTO. Moreover, these references submitted to the PTO and on the face of Negus reflect specific technology that Negus cited as examples of the type of known commercial products that could be used in implementing inventions very similar to that disclosed in Trigui. Such references are an explicit motivation to combine (and an explicit teaching of the referenced technology for anticipation purposes) and also provide a reasonable expectation

of success in the combination because at least one inventor (Negus) noted their suitability for the disclosure of technology similar to this reference.

- Trigui with one of Barak, Negus, Branlund, Li, Lo, Beaudin or Sun
- Trigui with one of the Antenna Spacing references above
- Trigui with Negus and one of the Antenna Spacing references above
- Trigui with Barak and one of the Antenna Spacing references above
- Trigui with Branlund and one of the Antenna Spacing references above
- Trigui with Lo and one of the Antenna Spacing references above
- Trigui with Adams and one of the Antenna Spacing references above
- Trigui combined with Sun and one of the Antenna Spacing references

- Trigui combined with Barak and one of Branlund or Beaudin
- Trigui combined with Barak and one of Li or Lo
- Trigui combined with Barak and one of Branlund or Negus
- Trigui combined with Barak and Sun

- Trigui combined with Negus and one of Branlund or Barak
- Trigui combined with Negus and one of Li or Lo
- Trigui combined with Negus and one of Branlund or Sun

- Trigui combined with Branlund and one of the Antenna Spacing References
- Trigui combined with Branlund and one of Negus or Barak
- Trigui combined with Branlund and Sun

- Trigui combined with Sun and one of Branlund or Barak
- Trigui combined with Sun and one of Negus or Barak

- Trigui combined with Lo and one of Branlund or Barak
- Trigui combined with Lo and Sun
- Trigui combined with Lo and one of Negus or Barak
-
- Trigui combined with the prosecution references(s) (Adams and/or Rudrapatna)
- Trigui combined with one or more of the prior art references cited in Negus and discussed in the Negus chart D07 (including AD9352, AD9353, AD9354, AD9355, AD9356 (or AD9357), DAN2400, Padhi)
- Trigui combined with one or more of AD9356, AD9357, DAN2400 and one of the Antenna Spacing references
-

To the extent Negus does not anticipate and/or render obvious on its own any of the ‘511 claims, a person of ordinary skill in the art would have been motivated to combine it with one or

two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Negus with any of these references as identified below because each of the references pertains to the same specific subject matter of using beamformed transmissions to effectuate MIMO wireless communications between a base station and a mobile device. The references pertain to the same technology and use the same terminology. Each of the references describes one or more antenna arrays that have multiple individual elements that are used for beamformed transmissions that are shaped by electronic circuits acting as beamformers. The individual beams represent MIMO streams. Those MIMO streams are aggregated by MIMO transceivers (using other terminology including “modems” or baseband units). Thus, a POSITA would be motivated to take beneficial aspects of Negus and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

Furthermore, for the references below that were identified specifically on the face of Negus and submitted to the PTO during the prosecution of Negus, a POSITA would be motivated to combine such references with Negus for the reason that the inventor thought these references so pertinent as to have submitted them to the PTO. Moreover, these references submitted to the PTO and on the face of Negus reflect specific technology that Negus cited as examples of the type of known commercial products that could be used in implementing inventions very similar to that disclosed in Negus. Such references are an explicit motivation to combine (and an explicit teaching of the referenced technology for anticipation purposes) and also provide a reasonable

expectation of success in the combination because at least one inventor (Negus) noted their suitability for the disclosure of technology similar to this reference.

In addition, Defendants intend to rely upon Negus combined with any one of the following Negus patents: USP 8,385,305; USP 8,649,418; USP 8,989,762; USP 8,502,733; USP 8,422,540; USP 8,761,100. A POSITA would be motivated to combine these because Negus and these patents were all part of the same product development effort by the same company, all largely contemporaneous with each other and invented by the same inventor(s). Defendants intend to rely upon Negus combined with the Fastback Network products.

- Negus with one of Barak, Trigui, Branlund, Li, Lo, Beaudin or Sun
- Negus with one of the Antenna Spacing references above
- Negus with Trigui and one of the Antenna Spacing references above
- Negus with Barak and one of the Antenna Spacing references above
- Negus with Branlund and one of the Antenna Spacing references above
- Negus with Lo and one of the Antenna Spacing references above
- Negus with Adams and one of the Antenna Spacing references above
- Negus combined with Sun and one of the Antenna Spacing references

- Negus combined with Barak and one of Branlund or Beaudin
- Negus combined with Barak and one of Li or Lo
- Negus combined with Barak and one of Branlund or Trigui
- Negus combined with Barak and Sun

- Negus combined with Trigui and one of Branlund or Barak
- Negus combined with Trigui and one of Li or Lo
- Negus combined with Trigui and one of Branlund or Sun

- Negus combined with Branlund and one of the Antenna Spacing References
- Negus combined with Branlund and one of Trigui or Barak
- Negus combined with Branlund and Sun

- Negus combined with Sun and one of Branlund or Barak
- Negus combined with Sun and one of Trigui or Barak

- Negus combined with Lo and one of Branlund or Barak
- Negus combined with Lo and Sun
- Negus combined with Lo and one of Negus or Barak

- Negus combined with the prosecution references(s) (Adams and/or Rudrapatna)
- Negus combined with one or more of the prior art references cited in Negus and discussed in the Negus chart D07 (including AD9352, AD9353, AD9354, AD9355, AD9356 (or AD9357), DAN2400, Padhi)
- Negus combined with one or more of AD9356, AD9357, DAN2400 and one of the Antenna Spacing references

To the extent Barak does not anticipate and/or render obvious on its own any of the ‘511 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Barak with any of these references as identified below because each of the references pertains to the same specific subject matter of using beamformed transmissions to effectuate MIMO wireless communications between a base station and a mobile device. The references pertain to the same technology and use the same terminology. Each of the references describes one or more antenna arrays that have multiple individual elements that are used for beamformed transmissions that are shaped by electronic circuits acting as beamformers. The individual beams represent MIMO streams. Those MIMO streams are aggregated by MIMO transceivers (using other terminology including “modems” or baseband units). Thus, a POSITA would be motivated to take beneficial aspects of Barak and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

Furthermore, for the references below that were identified specifically on the face of Negus and submitted to the PTO during the prosecution of Negus, a POSITA would be motivated to combine such references with Barak for the reason that the inventor thought these references so

pertinent as to have submitted them to the PTO. Moreover, these references submitted to the PTO and on the face of Negus reflect specific technology that Negus cited as examples of the type of known commercial products that could be used in implementing inventions very similar to that disclosed in Barak. Such references are an explicit motivation to combine (and an explicit teaching of the referenced technology for anticipation purposes) and also provide a reasonable expectation of success in the combination because at least one inventor (Negus) noted their suitability for the disclosure of technology similar to this reference.

Furthermore, for the references below that were identified specifically on the face of Negus and submitted to the PTO during the prosecution of Negus, a POSITA would be motivated to combine such references with Negus for the reason that the inventor thought these references so pertinent as to have submitted them to the PTO. Moreover, these references submitted to the PTO and on the face of Negus reflect specific technology that Negus cited as examples of the type of known commercial products that could be used in implementing Negus' invention. Such references are an explicit motivation to combine (and an explicit teaching of the referenced technology for anticipation purposes) and also provide a reasonable expectation of success in the combination because the inventor (Negus) noted their suitability for the disclosure of Negus.

- Barak with one of Negus, Trigui, Branlund, Li, Lo, Beaudin or Sun
- Barak with one of the Antenna Spacing references above
- Barak with Trigui and one of the Antenna Spacing references above
- Barak with Negus and one of the Antenna Spacing references above
- Barak with Branlund and one of the Antenna Spacing references above
- Barak with Lo and one of the Antenna Spacing references above
- Barak with Adams and one of the Antenna Spacing references above
- Barak combined with Sun and one of the Antenna Spacing references

- Barak combined with Negus and one of Branlund or Beaudin
- Barak combined with Negus and one of Li or Lo
- Barak combined with Negus and one of Branlund or Trigui
- Barak combined with Negus and Sun

- Barak combined with Trigui and one of Branlund or Negus
- Barak combined with Trigui and one of Li or Lo
- Barak combined with Trigui and one of Branlund or Sun
- Barak combined with Branlund and one of the Antenna Spacing References
- Barak combined with Branlund and one of Trigui or Negus
- Barak combined with Branlund and Sun
- Barak combined with Sun and one of Branlund or Negus
- Barak combined with Sun and one of Trigui or Negus
- Barak combined with Lo and one of Branlund or Negus
- Barak combined with Lo and Sun
- Barak combined with Lo and one of Negus or Trigui
- Barak combined with the prosecution references(s) (Adams and/or Rudrapatna)
- Barak combined with one or more of the prior art references cited in Barak and discussed in the Negus chart D07 (including AD9352, AD9353, AD9354, AD9355, AD9356 (or AD9357), DAN2400, Padhi).
- Barak combined with one or more of AD9356, AD9357, DAN2400 and one of the Antenna Spacing references

To the extent Branlund does not anticipate and/or render obvious on its own any of the ‘511 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Branlund with any of these references as identified below because each of the references pertains to the same specific subject matter of using beamformed transmissions to effectuate MIMO wireless communications between a base station and a mobile device. The references pertain to the same technology and use the same terminology. Each of the references describes one or more antenna arrays that have multiple individual elements that are used for beamformed transmissions that are shaped by electronic circuits acting as beamformers. The individual beams represent MIMO streams. Those MIMO streams are aggregated by MIMO transceivers (using other terminology including “modems” or

baseband units). Thus, a POSITA would be motivated to take beneficial aspects of Branlund and combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

Furthermore, for the references below that were identified specifically on the face of Negus and submitted to the PTO during the prosecution of Negus, a POSITA would be motivated to combine such references with Branlund for the reason that the inventor thought these references so pertinent as to have submitted them to the PTO. Moreover, these references submitted to the PTO and on the face of Negus reflect specific technology that Negus cited as examples of the type of known commercial products that could be used in implementing inventions very similar to that disclosed in Branlund. Such references are an explicit motivation to combine (and an explicit teaching of the referenced technology for anticipation purposes) and also provide a reasonable expectation of success in the combination because at least one inventor (Negus) noted their suitability for the disclosure of technology similar to this reference.

- Branlund with one of Negus, Trigui, Barak, Li, Lo, Beaudin or Sun
- Branlund with one of the Antenna Spacing references above
- Branlund with Trigui and one of the Antenna Spacing references above
- Branlund with Branlund and one of the Antenna Spacing references above
- Branlund with Negus and one of the Antenna Spacing references above
- Branlund with Lo and one of the Antenna Spacing references above
- Branlund with Adams and one of the Antenna Spacing references above
- Branlund combined with Sun and one of the Antenna Spacing references

- Branlund combined with Negus and one of Barak or Beaudin
- Branlund combined with Negus and one of Li or Lo
- Branlund combined with Negus and one of Barak or Trigui
- Branlund combined with Negus and Sun

- Branlund combined with Trigui and one of Barak or Negus
- Branlund combined with Trigui and one of Li or Lo
- Branlund combined with Trigui and one of Barak or Sun

- Branlund combined with Barak and one of the Antenna Spacing References
- Branlund combined with Barak and one of Trigui or Negus
- Branlund combined with Barak and Sun
- Branlund combined with Sun and one of Barak or Negus
- Branlund combined with Sun and one of Trigui or Negus
- Branlund combined with Lo and one of Barak or Negus
- Branlund combined with Lo and Sun
- Branlund combined with Lo and one of Negus or Trigui
- Branlund combined with the prosecution references(s) (Adams and/or Rudrapatna)
- Branlund combined with one or more of the prior art references cited in Branlund and discussed in the Negus chart D07 (including AD9352, AD9353, AD9354, AD9355, AD9356 (or AD9357), DAN2400, Padhi).
- Branlund combined with one or more of AD9356, AD9357, DAN2400 and one of the Antenna Spacing references

To the extent Beaudin does not anticipate and/or render obvious on its own any of the ‘511 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Beaudin with any of these references as identified below because each of the references pertains to the same specific subject matter of using beamformed transmissions to effectuate MIMO wireless communications between a base station and a mobile device. The references pertain to the same technology and use the same terminology. Each of the references describes one or more antenna arrays that have multiple individual elements that are used for beamformed transmissions that are shaped by electronic circuits acting as beamformers. The individual beams represent MIMO streams. Those MIMO streams are aggregated by MIMO transceivers (using other terminology including “modems” or baseband units). Thus, a POSITA would be motivated to take beneficial aspects of Beaudin and

combine them with the other aspects reflected in the references. Furthermore because the references are so similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

Furthermore, for the references below that were identified specifically on the face of Negus and submitted to the PTO during the prosecution of Negus, a POSITA would be motivated to combine such references with Beaudin for the reason that the inventor thought these references so pertinent as to have submitted them to the PTO. Moreover, these references submitted to the PTO and on the face of Negus reflect specific technology that Negus cited as examples of the type of known commercial products that could be used in implementing inventions very similar to that disclosed in Beaudin. Such references are an explicit motivation to combine (and an explicit teaching of the referenced technology for anticipation purposes) and also provide a reasonable expectation of success in the combination because at least one inventor (Negus) noted their suitability for the disclosure of technology similar to this reference.

- Beaudin with one of Negus, Trigui, Barak, Li, Lo, Branlund or Sun
- Beaudin with one of the Antenna Spacing references above
- Beaudin with Trigui and one of the Antenna Spacing references above
- Beaudin with Branlund and one of the Antenna Spacing references above
- Beaudin with Negus and one of the Antenna Spacing references above
- Beaudin with Lo and one of the Antenna Spacing references above
- Beaudin with Adams and one of the Antenna Spacing references above
- Beaudin combined with Sun and one of the Antenna Spacing references

- Beaudin combined with Negus and one of Barak or Branlund
- Beaudin combined with Negus and one of Li or Lo
- Beaudin combined with Negus and one of Barak or Trigui
- Beaudin combined with Negus and Sun

- Beaudin combined with Trigui and one of Barak or Negus
- Beaudin combined with Trigui and one of Li or Lo
- Beaudin combined with Trigui and one of Barak or Sun

- Beaudin combined with Barak and one of the Antenna Spacing References

- Beaudin combined with Barak and one of Trigui or Negus
- Beaudin combined with Barak and Sun
- Beaudin combined with Sun and one of Barak or Negus
- Beaudin combined with Sun and one of Trigui or Negus
- Beaudin combined with Lo and one of Barak or Negus
- Beaudin combined with Lo and Sun
- Beaudin combined with Lo and one of Negus or Trigui
- Beaudin combined with the prosecution references(s) (Adams and/or Rudrapatna)
- Beaudin combined with one or more of the prior art references cited in Beaudin and discussed in the Negus chart D07 (including AD9352, AD9353, AD9354, AD9355, AD9356 (or AD9357), DAN2400, Padhi).
- Beaudin combined with one or more of AD9356, AD9357, DAN2400 and one of the Antenna Spacing references

To the extent Lo does not anticipate and/or render obvious on its own any of the ‘511 claims, a person of ordinary skill in the art would have been motivated to combine it with one or two of the following other references, for the reasons noted below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have been motivated to combine Lo with any of these references as identified below because each of the references pertains to the same specific subject matter of using beamformed transmissions to effectuate MIMO wireless communications between a base station and a mobile device. The references pertain to the same technology and use the same terminology. Each of the references describes one or more antenna arrays that have multiple individual elements that are used for beamformed transmissions that are shaped by electronic circuits acting as beamformers. The individual beams represent MIMO streams. Those MIMO streams are aggregated by MIMO transceivers (using other terminology including “modems” or baseband units). Thus, a POSITA would be motivated to take beneficial aspects of Lo and combine them with the other aspects reflected in the references. Furthermore because the references are so

similar and use such similar technologies, a POSITA would have a reasonable expectation of success in such combinations.

Furthermore, for the references below that were identified specifically on the face of Negus and submitted to the PTO during the prosecution of Negus, a POSITA would be motivated to combine such references with Lo for the reason that the inventor thought these references so pertinent as to have submitted them to the PTO. Moreover, these references submitted to the PTO and on the face of Negus reflect specific technology that Negus cited as examples of the type of known commercial products that could be used in implementing inventions very similar to that disclosed in Lo. Such references are an explicit motivation to combine (and an explicit teaching of the referenced technology for anticipation purposes) and also provide a reasonable expectation of success in the combination because at least one inventor (Negus) noted their suitability for the disclosure of technology similar to this reference.

- Lo with one of Negus, Trigui, Barak, Li, Beaudin, Branlund or Sun
- Lo with one of the Antenna Spacing references above
- Lo with Trigui and one of the Antenna Spacing references above
- Lo with Branlund and one of the Antenna Spacing references above
- Lo with Negus and one of the Antenna Spacing references above
- Lo with Lo and one of the Antenna Spacing references above
- Lo with Adams and one of the Antenna Spacing references above
- Lo combined with Sun and one of the Antenna Spacing references

- Lo combined with Negus and one of Barak or Branlund
- Lo combined with Negus and one of Li or Beaudin
- Lo combined with Negus and one of Barak or Trigui
- Lo combined with Negus and Sun

- Lo combined with Trigui and one of Barak or Negus
- Lo combined with Trigui and one of Li or Beaudin
- Lo combined with Trigui and one of Barak or Sun

- Lo combined with Barak and one of the Antenna Spacing References
- Lo combined with Barak and one of Trigui or Negus
- Lo combined with Barak and Sun

- Lo combined with Sun and one of Barak or Negus
- Lo combined with Sun and one of Trigui or Negus
- Lo combined with Beaudin and one of Barak or Negus
- Lo combined with Beaudin and Sun
- Lo combined with Beaudin and one of Negus or Trigui
- Lo combined with the prosecution references(s) (Adams and/or Rudrapatna)
- Lo combined with one or more of the prior art references cited in Lo and discussed in the Negus chart D07 (including AD9352, AD9353, AD9354, AD9355, AD9356 (or AD9357), DAN2400, Padhi).
- Lo combined with one or more of AD9356, AD9357, DAN2400 and one of the Antenna Spacing references

j. Exemplary Combinations For ‘369 Patent

As explained above, Defendants contend that a person of ordinary skill in the art would have been motivated to combine with a reasonable expectation of success any of the primary references in these Invalidity Contentions with (1) any other primary reference, (2) any reference disclosed in in the section above for specific concepts claimed in the patent, (3) any statements made in the intrinsic record of the patent, and/or (4) the knowledge of one of ordinary skill in the art. By way of example only, Defendants provide the following exemplary combinations and some of the reasons a person of ordinary skill in the art would be motivated to combine references.

To the extent Li 748 does not anticipate and/or render obvious on its own any of the ‘369 claims, a person of ordinary skill in the art would have been motivated to combine Li 748 with one or two of the following other references, for the reasons noted in the chart below, as well as for the reasons described throughout this Section with a reasonable expectation of success.

A POSITA would have a motivation to combine Li 748 with Li 827 for at least the following reasons: Li 827 expressly incorporates by reference the Li 748 patent. Both references were filed by the same company (Adaptix) and had overlapping inventors. Both references relate

to the same technology and use the same equipment and terminology. Both references describe measuring the channel conditions and using the reverse path signal to calculate a parameter to adjust the forward path (downlink) transmissions including by adjusting the power levels of one or more OFDM tones.

A POSITA would have a motivation to combine Li 748 with Wong for at least the following reasons: Li 748 expressly references Wong and describes Wong's techniques as being "advantageous" for solving problems such as the multipath problem. See Li 748 at 1:42-53. Li 748 references the benefits of adjusting the downlink data transmissions including through the use of OFDM tone level power adjustments and Wong is focused on such adjustments and the benefits and techniques of OFDM tone power management. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Both references use the same modulation techniques such as OFDM.

A POSITA would have a motivation to combine Li 748 with Agee 923 for at least the following reasons: Both references use the same modulation techniques such as OFDM. Li 748 references the benefits of adjusting the downlink data transmissions including through the use of OFDM tone level power adjustments and Agee 923 is focused on such adjustments and the benefits and techniques of OFDM tone power management. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Agee 923 provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in Li 748 by providing specific improvements in the wireless transmission path between the base station and

the remote units which corresponds to and further improves the goal of Li 748 to improve such transmissions. Agee 923 teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Li 748 to improve data transmissions.

A POSITA would have a motivation to combine Li 748 with Minn for at least the following reasons: Both references use the same modulation techniques such as OFDM. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Minn identifies and provides specific improvements for the channel estimation that a POSITA would recognize as further improving the goals of Li 748 to provide improved transmissions on the forward link. Minn specifically identifies the benefits of using a time domain measurement converted to a frequency domain parameter for estimating the channel characteristics to use for downlink transmissions. Minn teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Li 748 to improve data transmissions.

A POSITA would have a motivation to combine Li 748 with Lehne for at least the following reasons: Both references use the same modulation techniques such as OFDM. Li 748 references the benefits of adjusting the downlink data transmissions and Lehne further teaches such adjustments and the benefits and techniques of such adjustments to the downlink transmissions. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Lehne provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and

antennas referenced in Li 748 by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of Li 748 to improve such transmissions. Lehne teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Li 748 to improve data transmissions.

A POSITA would have a motivation to combine Li 748 with Yeh for at least the following reasons: Both references use the same modulation techniques such as OFDM. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Yeh identifies and provides specific improvements for the channel estimation in an OFDM system that a POSITA would recognize as further improving the goals of Li 748 to provide improved transmissions on the forward link. Yeh specifically identifies the benefits of using a time domain measurement converted to a frequency domain parameter for estimating the channel characteristics to use for downlink transmissions. Yeh teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Li 748 to improve data transmissions.

A POSITA would have a motivation to combine Li 748 with Yamamoto for at least the following reasons: As noted in the chart E-08, the Examiner already determined that Yeh either discloses, or renders obvious by itself, all of the elements of the asserted '369 claims except for the passage regarding "where said modifying includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal" and the '369 applicant did not challenge and acquiesced in such determination. Li 748 teaches the exact element allegedly missing in Yamamoto in the context of a system very similar to Yamamoto for the same goal of improving downlink transmissions from

a base station to a remote terminal. Li 748 provides a system similar to Yamamoto allowing for adjustment of downlink transmissions based upon signals on the reverse/uplink path. Yamamoto provides a method for channel estimation using a time delay converted into a forward path frequency channel parameter used to adjust the forward path with the technique being a recognized improvement for Li 748's method of doing the same adjustment. Yamamoto provides an express teaching of using an identifiable training sequence (of a known signal) to measure the reverse path for calculating an adjustment (predistortion) factor to be applied to the forward path transmissions and a POSITA would recognize the benefits of the usage of such a training sequence for the reasons stated in the Training Data sequence above and that those benefits would apply to the system in Li 748 to improve the downlink transmissions therein.

A POSITA would have a motivation to combine Li 748 with Litva for at least the following reasons: Both references use the same modulation techniques such as OFDM. This reference teaches the benefits of adjusting the downlink data transmissions and Litva further teaches such adjustments and the benefits and techniques of such adjustments to the downlink transmissions. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Litva provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in this reference by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of this reference to improve such transmissions. Litva teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which

a POSITA would recognize would benefit the techniques in this reference to improve data transmissions. As noted above, Li 748 can be combined with one or two of the references above. Without prejudice to any other combinations, Defendants identify specifically the following combinations:

- Li 748 with one of Li 827, Wong, Agee 923, Minn, Lehne, Yeh, or Yamamoto
- Li 748 with one of the Channel Estimation and one of the Antenna Array references above
- Li 748 with one of the Channel Estimation and one of the OFDM Tone Modification references above
- Li 748 with one of the Channel Estimation and one of the Training Data references above
- Li 748 with one of the Channel Estimation and one of the QPSK Usage references above
- Li 748 with one of the OFDM Tone Modification and one of the Antenna Array references above
- Li 748 with one of the OFDM Tone Modification and one of the Training Data references above
- Li 748 with one of the OFDM Tone Modification and one of the QPSK Usage references above
- Li 748 with one of the Antenna Array and one of the QPSK Usage references above
- Li 748 combined with Li 827 and one of the Antenna Array references above
- Li 748 combined with Li 827 and one of Minn or Yeh
- Li 748 combined with Li 827 and one of Agee 923 or Wong
- Li 748 combined with Li 827 and one of Agee 923 or Yamamoto
- Li 748 combined with Wong and one of Antenna Array references above
- Li 748 combined with Wong and one of Minn or Yeh
- Li 748 combined with Wong and one of Agee 923 or Yamamoto
- Li 748 combined with Antenna Array references above
- Li 748 combined with Agee 923 and one of Minn or Yeh
- Li 748 combined with Agee 923 and one of Yamamoto or Wong
- Li 748 combined with Minn and one of Antenna Array references above
- Li 748 combined with Minn and one of Agee 923 or Wong
- Li 748 combined with Yeh and one of Antenna Array references above
- Li 748 combined with Yeh and Yamamoto

- Li 748 combined with Yamamoto and one of Antenna Array references above
- Li 748 combined with Yamamoto and one of Minn or Yeh

The motivations to combine such references with a reasonable expectation of success are detailed in the passages above.

To the extent Li 827 does not anticipate and/or render obvious on its own any of the ‘369 claims, a person of ordinary skill in the art would have been motivated to combine Li 827 with one or two of the following other references, for the reasons noted in the chart below, as well as for the reasons described throughout this Section with a reasonable expectation of success:

A POSITA would have a motivation to combine Li 827 with Li 748 for at least the following reasons: Li 827 expressly incorporates by reference the Li 748 patent. Both references were filed by the same company (Adaptix) and had overlapping inventors. Both references relate to the same technology and use the same equipment and terminology. Both references describe measuring the channel conditions and using the reverse path signal to calculate a parameter to adjust the forward path (downlink) transmissions including by adjusting the power levels of one or more OFDM tones.

A POSITA would have a motivation to combine Li 827 with Wong for at least the following reasons: Li 827 incorporates by reference Li 848 and Li 848 expressly references Wong and describes Wong’s techniques as being “advantageous” for solving problems such as the multipath problem. See Li 848 at 1:42-53. Li 827 references the benefits of adjusting the downlink data transmissions including through the use of OFDM tone level power adjustments and Wong is focused on such adjustments and the benefits and techniques of OFDM tone power management. Both references address the benefits and use of channel estimation based on reverse path data

signals to adapt the forward path data transmissions. Both references use the same modulation techniques such as OFDM.

A POSITA would have a motivation to combine Li 827 with Agee 923 for at least the following reasons: Both references use the same modulation techniques such as OFDM. Li 827 references the benefits of adjusting the downlink data transmissions including through the use of OFDM tone level power adjustments and Agee 923 is focused on such adjustments and the benefits and techniques of OFDM tone power management. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Agee 923 provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in Li 827 by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of Li 827 to improve such transmissions. Agee 923 teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Li 827 to improve data transmissions.

A POSITA would have a motivation to combine Li 827 with Minn for at least the following reasons: Both references use the same modulation techniques such as OFDM. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Minn identifies and provides specific improvements for the channel estimation that a POSITA would recognize as further improving the goals of Li 827 to provide improved transmissions on the forward link.

Minn specifically identifies the benefits of using a time domain measurement converted to a frequency domain parameter for estimating the channel characteristics to use for downlink transmissions. Minn teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Li 827 to improve data transmissions.

A POSITA would have a motivation to combine Li 827 with Lehne for at least the following reasons: Both references use the same modulation techniques such as OFDM. Li 827 references the benefits of adjusting the downlink data transmissions and Lehne further teaches such adjustments and the benefits and techniques of such adjustments to the downlink transmissions. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Lehne provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in Li 827 by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of Li 827 to improve such transmissions. Lehne teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Li 827 to improve data transmissions.

A POSITA would have a motivation to combine Li 827 with Yeh for at least the following reasons: Both references use the same modulation techniques such as OFDM. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Yeh identifies and provides specific improvements for the

channel estimation in an OFDM system that a POSITA would recognize as further improving the goals of Li 827 to provide improved transmissions on the forward link. Yeh specifically identifies the benefits of using a time domain measurement converted to a frequency domain parameter for estimating the channel characteristics to use for downlink transmissions. Yeh teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Li 827 to improve data transmissions.

A POSITA would have a motivation to combine Li 827 with Yamamoto for at least the following reasons: As noted in the chart E-08, the Examiner already determined that Yeh either discloses, or renders obvious by itself, all of the elements of the asserted ‘369 claims except for the passage regarding “where said modifying includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal” and the ‘369 applicant did not challenge and acquiesced in such determination. Li 827 teaches the exact element allegedly missing in Yamamoto in the context of a system very similar to Yamamoto for the same goal of improving downlink transmissions from a base station to a remote terminal. Li 827 provides a system similar to Yamamoto allowing for adjustment of downlink transmissions based upon signals on the reverse/uplink path. Yamamoto provides a method for channel estimation using a time delay converted into a forward path frequency channel parameter used to adjust the forward path with the technique being a recognized improvement for Li 827’s method of doing the same adjustment. Yamamoto provides an express teaching of using an identifiable training sequence (of a known signal) to measure the reverse path for calculating an adjustment (predistortion) factor to be applied to the forward path transmissions and a POSITA would recognize the benefits of the usage of such a training sequence for the reasons

stated in the Training Data sequence above and that those benefits would apply to the system in Li 827 to improve the downlink transmissions therein.

A POSITA would have a motivation to combine Li 827 with Litva for at least the following reasons: Both references use the same modulation techniques such as OFDM. This reference teaches the benefits of adjusting the downlink data transmissions and Litva further teaches such adjustments and the benefits and techniques of such adjustments to the downlink transmissions. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Litva provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in this reference by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of this reference to improve such transmissions. Litva teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in this reference to improve data transmissions.

As noted above, Li 748 can be combined with one or two of the references above. Without prejudice to any other combinations, Defendants identify specifically the following combinations:

- Li 827 with one of Li 748, Wong, Agee 923, Minn, Lehne, Yeh, or Yamamoto
- Li 827 with one of the Channel Estimation and one of the Antenna Array references above
- Li 827 with one of the Channel Estimation and one of the OFDM Tone Modification references above
- Li 827 with one of the Channel Estimation and one of the Training Data references above

- Li 827 with one of the Channel Estimation and one of the QPSK Usage references above
- Li 827 with one of the OFDM Tone Modification and one of the Antenna Array references above
- Li 827 with one of the OFDM Tone Modification and one of the Training Data references above
- Li 827 with one of the OFDM Tone Modification and one of the QPSK Usage references above
- Li 827 with one of the Antenna Array and one of the QPSK Usage references above

- Li 827 combined with Li 748 and one of Agee 923 or Lehne or Litva
- Li 827 combined with Li 748 and one of Minn or Yeh
- Li 827 combined with Li 748 and one of Agee 923 or Wong
- Li 827 combined with Li 748 and one of Agee 923 or Yamamoto

- Li 827 combined with Wong and one of Agee 923 or Lehne or Litva
- Li 827 combined with Wong and one of Minn or Yeh
- Li 827 combined with Wong and one of Agee 923 or Yamamoto

- Li 827 combined with Agee 923 and Lehne
- Li 827 combined with Agee 923 and one of Minn or Yeh
- Li 827 combined with Agee 923 and one of Yamamoto or Wong

- Li 827 combined with Minn and one of Agee 923 or Lehne or Litva
- Li 827 combined with Minn and one of Agee 923 or Wong

- Li 827 combined with Yeh and one of Agee 923 or Lehne or Litva
- Li 827 combined with Yeh and Yamamoto

- Li 827 combined with Yamamoto and one of Agee 923 or Lehne or Litva
- Li 827 combined with Yamamoto and one of Minn or Yeh

The motivations to combine such references with a reasonable expectation of success are detailed in the passages above.

To the extent Wong does not anticipate and/or render obvious on its own any of the ‘369 claims, a person of ordinary skill in the art would have been motivated to combine Wong with one or two of the following other references, for the reasons noted in the chart below, as well as for the reasons described throughout this Section with a reasonable expectation of success:

A POSITA would have a motivation to combine Wong with Li 748 for at least the following reasons: Wong is expressly incorporated by reference in the Li 748 patent. Both references relate to the same technology and use the same equipment and terminology. Both references describe measuring the channel conditions and using the reverse path signal to calculate a parameter to adjust the forward path (downlink) transmissions including by adjusting the power levels of one or more OFDM tones. Wong references the benefits of adjusting the downlink data transmissions including through the use of OFDM tone level power adjustments and Li 748 is focused on such adjustments and the benefits and techniques of OFDM tone power management.

A POSITA would have a motivation to combine Wong with Li 827 for at least the following reasons: Li 827 incorporates by reference Li 848 and Li 848 expressly references Wong and describes Wong's techniques as being "advantageous" for solving problems such as the multipath problem. See Li 848 at 1:42-53. Wong references the benefits of adjusting the downlink data transmissions including through the use of OFDM tone level power adjustments and Li 827 is focused on such adjustments and the benefits and techniques of OFDM tone power management. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Both references use the same modulation techniques such as OFDM.

A POSITA would have a motivation to combine Wong with Agee 923 for at least the following reasons: Both references use the same modulation techniques such as OFDM. Wong references the benefits of adjusting the downlink data transmissions including through the use of OFDM tone level power adjustments and Agee 923 is focused on such adjustments and the benefits and techniques of OFDM tone power management. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data

transmissions. Agee 923 provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in Wong by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of Wong to improve such transmissions. Agee 923 teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Wong to improve data transmissions.

A POSITA would have a motivation to combine Wong with Minn for at least the following reasons: Both references use the same modulation techniques such as OFDM. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Minn identifies and provides specific improvements for the channel estimation that a POSITA would recognize as further improving the goals of Wong to provide improved transmissions on the forward link. Minn specifically identifies the benefits of using a time domain measurement converted to a frequency domain parameter for estimating the channel characteristics to use for downlink transmissions. Minn teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Wong to improve data transmissions. Wong expressly focuses on the adaptation of the downlink transmissions given a channel estimation of the propagation path (for example on the reverse link) and Minn expressly teaches the aspect that Wong assumes (the measurement of the reverse path and parameters to use to adapt the forward path).

A POSITA would have a motivation to combine Wong with Lehne for at least the following reasons: Both references use the same modulation techniques such as OFDM. Wong references the benefits of adjusting the downlink data transmissions and Lehne further teaches such adjustments and the benefits and techniques of such adjustments to the downlink transmissions.

Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Lehne provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in Wong by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of Wong to improve such transmissions. Lehne teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Wong to improve data transmissions.

A POSITA would have a motivation to combine Wong with Yeh for at least the following reasons: Both references use the same modulation techniques such as OFDM. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Yeh identifies and provides specific improvements for the channel estimation in an OFDM system that a POSITA would recognize as further improving the goals of Wong to provide improved transmissions on the forward link. Yeh specifically identifies the benefits of using a time domain measurement converted to a frequency domain parameter for estimating the channel characteristics to use for downlink transmissions. Wong expressly focuses on the adaptation of the downlink transmissions given a channel estimation of the propagation path

(for example on the reverse link) and Yeh expressly teaches the aspect that Wong assumes (the measurement of the reverse path and parameters to use to adapt the forward path). Yeh teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Wong to improve data transmissions.

A POSITA would have a motivation to combine Wong with Yamamoto for at least the following reasons: As noted in the chart E-08, the Examiner already determined that Yeh either discloses, or renders obvious by itself, all of the elements of the asserted '369 claims except for the passage regarding "where said modifying includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal" and the '369 applicant did not challenge and acquiesced in such determination. Wong teaches the exact element allegedly missing in Yamamoto in the context of a system very similar to Yamamoto for the same goal of improving downlink transmissions from a base station to a remote terminal. Wong provides a system similar to Yamamoto allowing for adjustment of downlink transmissions based upon signals on the reverse/uplink path. Yamamoto provides a method for channel estimation using a time delay converted into a forward path frequency channel parameter used to adjust the forward path with the technique being a recognized improvement for Wong's method of doing the same adjustment. Yamamoto provides an express teaching of using an identifiable training sequence (of a known signal) to measure the reverse path for calculating an adjustment (predistortion) factor to be applied to the forward path transmissions and a POSITA would recognize the benefits of the usage of such a training sequence for the reasons stated in the Training Data sequence above and that those benefits would apply to the system in Wong to improve the downlink transmissions therein

A POSITA would have a motivation to combine Wong with Litva for at least the following reasons: Both references use the same modulation techniques such as OFDM. This reference teaches the benefits of adjusting the downlink data transmissions and Litva further teaches such adjustments and the benefits and techniques of such adjustments to the downlink transmissions. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Litva provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in this reference by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of this reference to improve such transmissions. Litva teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in this reference to improve data transmissions.

As noted above, Wong can be combined with one or two of the references above. Without prejudice to any other combinations, Defendants identify specifically the following combinations:

- Wong with one of Li 748, Li 827, Agee 923, Minn, Lehne, Yeh, or Yamamoto
- Wong with one of the Channel Estimation and one of the Antenna Array references above
- Wong with one of the Channel Estimation and one of the OFDM Tone Modification references above
- Wong with one of the Channel Estimation and one of the Training Data references above
- Wong with one of the Channel Estimation and one of the QPSK Usage references above
- Wong with one of the OFDM Tone Modification and one of the Antenna Array references above

- Wong with one of the OFDM Tone Modification and one of the Training Data references above
- Wong with one of the OFDM Tone Modification and one of the QPSK Usage references above
- Wong with one of the Antenna Array and one of the QPSK Usage references above
- Wong combined with Li 748 and one of Agee 923 or Lehne or Litva
- Wong combined with Li 748 and one of Minn or Yeh
- Wong combined with Li 748 and one of Agee 923 or Li 827
- Wong combined with Li 748 and one of Agee 923 or Yamamoto
- Wong combined with Li 827 and one of Agee 923 or Lehne or Litva
- Wong combined with Li 827 and one of Minn or Yeh
- Wong combined with Li 827 and one of Agee 923 or Yamamoto
- Wong combined with Agee 923 and Lehne
- Wong combined with Agee 923 and one of Minn or Yeh
- Wong combined with Agee 923 and one of Yamamoto or Li 827
- Wong combined with Minn and one of Agee 923 or Lehne or Litva
- Wong combined with Minn and one of Li 827 or Li 748
- Wong combined with Yeh and one of Agee 923 or Lehne or Litva
- Wong combined with Yeh and Yamamoto
- Wong combined with Yamamoto and one of Agee 923 or Lehne or Litva
- Wong combined with Yamamoto and one of Minn or Yeh

The motivations to combine such references with a reasonable expectation of success are detailed in the passages above.

To the extent Agee 923 does not anticipate and/or render obvious on its own any of the ‘369 claims, a person of ordinary skill in the art would have been motivated to combine Agee 923 with one or two of the following other references, for the reasons noted in the chart below, as well as for the reasons described throughout this Section with a reasonable expectation of success:

A POSITA would have a motivation to combine Agee 923 with Li 748 for at least the following reasons: Both references relate to the same technology and use the same equipment and

terminology. Both references describe measuring the channel conditions and using the reverse path signal to calculate a parameter to adjust the forward path (downlink) transmissions including by adjusting the power levels of one or more OFDM tones. Agee 923 references the benefits of adjusting the downlink data transmissions including through the use of OFDM tone level power adjustments and Li 748 is focused on such adjustments and the benefits and techniques of OFDM tone power management.

A POSITA would have a motivation to combine Agee 923 with Li 827 for at least the following reasons: Agee 923 references the benefits of adjusting the downlink data transmissions including through the use of OFDM tone level power adjustments and Li 827 is focused on such adjustments and the benefits and techniques of OFDM tone power management. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Both references use the same modulation techniques such as OFDM.

A POSITA would have a motivation to combine Agee 923 with Wong for at least the following reasons: Both references use the same modulation techniques such as OFDM. Agee 923 references the benefits of adjusting the downlink data transmissions including through the use of OFDM tone level power adjustments and Wong is focused on such adjustments and the benefits and techniques of OFDM tone power management. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions.

A POSITA would have a motivation to combine Agee 923 with Minn for at least the following reasons: Both references use the same modulation techniques such as OFDM. Both references address the benefits and use of channel estimation based on reverse path data signals to

adapt the forward path data transmissions. Minn identifies and provides specific improvements for the channel estimation that a POSITA would recognize as further improving the goals of Agee 923 to provide improved transmissions on the forward link. Minn specifically identifies the benefits of using a time domain measurement converted to a frequency domain parameter for estimating the channel characteristics to use for downlink transmissions which would improve Agee 923's system for the reasons stated in Minn. Minn teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Agee 923 to improve data transmissions. Agee 923 expressly focuses on the adaptation of the downlink transmissions given a channel estimation of the propagation path (for example on the reverse link) and Minn expressly teaches the aspect that Agee 923 assumes (the measurement of the reverse path and parameters to use to adapt the forward path).

A POSITA would have a motivation to combine Agee 923 with Lehne for at least the following reasons: Both references use the same modulation techniques such as OFDM. Agee 923 references the benefits of adjusting the downlink data transmissions and Lehne further teaches such adjustments and the benefits and techniques of such adjustments to the downlink transmissions. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Lehne provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in Agee 923 by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the

goal of Agee 923 to improve such transmissions. Lehne teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Agee 923 to improve data transmissions.

A POSITA would have a motivation to combine Agee 923 with Yeh for at least the following reasons: Both references use the same modulation techniques such as OFDM. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Yeh identifies and provides specific improvements for the channel estimation in an OFDM system that a POSITA would recognize as further improving the goals of Agee 923 to provide improved transmissions on the forward link. Yeh specifically identifies the benefits of using a time domain measurement converted to a frequency domain parameter for estimating the channel characteristics to use for downlink transmissions which would improve Agee 923's system for the reasons stated in Minn. Agee 923 expressly focuses on the adaptation of the downlink transmissions given a channel estimation of the propagation path (for example on the reverse link) and Yeh expressly teaches the aspect that Agee 923 assumes (the measurement of the reverse path and parameters to use to adapt the forward path). Yeh teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Agee 923 to improve data transmissions.

A POSITA would have a motivation to combine Agee 923 with Yamamoto for at least the following reasons: As noted in the chart E-08, the Examiner already determined that Yeh either discloses, or renders obvious by itself, all of the elements of the asserted '369 claims except for the passage regarding "where said modifying includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said

forward path data signal” and the ‘369 applicant did not challenge and acquiesced in such determination. Agee 923 teaches the exact element allegedly missing in Yamamoto in the context of a system very similar to Yamamoto for the same goal of improving downlink transmissions from a base station to a remote terminal. Agee 923 provides a system similar to Yamamoto allowing for adjustment of downlink transmissions based upon signals on the reverse/uplink path. Yamamoto provides a method for channel estimation using a time delay converted into a forward path frequency channel parameter used to adjust the forward path with the technique being a recognized improvement for Agee 923’s method of doing the same adjustment. Yamamoto provides an express teaching of using an identifiable training sequence (of a known signal) to measure the reverse path for calculating an adjustment (predistortion) factor to be applied to the forward path transmissions and a POSITA would recognize the benefits of the usage of such a training sequence for the reasons stated in the Training Data sequence above and that those benefits would apply to the system in Agee 923 to improve the downlink transmissions therein.

A POSITA would have a motivation to combine Agee 923 with Litva for at least the following reasons: Both references use the same modulation techniques such as OFDM. This reference teaches the benefits of adjusting the downlink data transmissions and Litva further teaches such adjustments and the benefits and techniques of such adjustments to the downlink transmissions. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Litva provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in this reference by providing specific improvements in the wireless

transmission path between the base station and the remote units which corresponds to and further improves the goal of this reference to improve such transmissions. Litva teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in this reference to improve data transmissions.

As noted above, Agee 923 can be combined with one or two of the references above. Without prejudice to any other combinations, Defendants identify specifically the following combinations:

- Agee 923 with one of Li 748, Li 827, Wong, Minn, Lehne, Yeh, or Yamamoto
- Agee 923 with one of the Channel Estimation and one of the Antenna Array references above
- Agee 923 with one of the Channel Estimation and one of the OFDM Tone Modification references above
- Agee 923 with one of the Channel Estimation and one of the Training Data references above
- Agee 923 with one of the Channel Estimation and one of the QPSK Usage references above
- Agee 923 with one of the OFDM Tone Modification and one of the Antenna Array references above
- Agee 923 with one of the OFDM Tone Modification and one of the Training Data references above
- Agee 923 with one of the OFDM Tone Modification and one of the QPSK Usage references above
- Agee 923 with one of the Antenna Array and one of the QPSK Usage references above

- Agee 923 combined with Li 748 and Lehne
- Agee 923 combined with Li 748 and one of Minn or Yeh
- Agee 923 combined with Li 748 and one of Wong or Li 827
- Agee 923 combined with Li 748 and Yamamoto

- Agee 923 combined with Li 827 and Lehne
- Agee 923 combined with Li 827 and one of Minn or Yeh
- Agee 923 combined with Li 827 and one of Wong or Yamamoto

- Agee 923 combined with Wong and one of Minn or Yeh
- Agee 923 combined with Wong and Lehne

- Agee 923 combined with Minn and Lehne
- Agee 923 combined with Minn and one of Li 827 or Li 748
- Agee 923 combined with Yeh and Lehne
- Agee 923 combined with Yeh and Yamamoto
- Agee 923 combined with Yamamoto and Lehne
- Agee 923 combined with Yamamoto and one of Minn or Wong

The motivations to combine such references with a reasonable expectation of success are detailed in the passages above.

To the extent Minn does not anticipate and/or render obvious on its own any of the ‘369 claims, a person of ordinary skill in the art would have been motivated to combine Minn with one or two of the following other references, for the reasons noted in the chart below, as well as for the reasons described throughout this Section with a reasonable expectation of success:

A POSITA would have a motivation to combine Minn with Li 748 for at least the following reasons: Both references relate to the same technology and use the same equipment and terminology. Both references describe measuring the channel conditions and using the reverse path signal to calculate a parameter to adjust the forward path (downlink) transmissions including by adjusting the power levels of one or more OFDM tones. Minn teaches the benefits of a particular approach for channel measurement and Li 748 is focused on such adjustments and the benefits and techniques of OFDM tone power management based on channel measurement.

A POSITA would have a motivation to combine Minn with Li 827 for at least the following reasons: Minn teaches the benefits of a particular approach for channel measurement and Li 827 is focused on such adjustments and the benefits and techniques of OFDM tone power management based on channel measurement. Both references address the benefits and use of channel estimation

based on reverse path data signals to adapt the forward path data transmissions. Both references use the same modulation techniques such as OFDM.

A POSITA would have a motivation to combine Minn with Wong for at least the following reasons: Both references use the same modulation techniques such as OFDM. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Minn identifies and provides specific improvements for the channel estimation that a POSITA would recognize as further improving the goals of Wong to provide improved transmissions on the forward link. Minn specifically identifies the benefits of using a time domain measurement converted to a frequency domain parameter for estimating the channel characteristics to use for downlink transmissions and Wong uses the uplink channel characterization (however that is determined) to provide improvements in downlink performance. Minn teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Wong to improve data transmissions. Wong expressly focuses on the adaptation of the downlink transmissions given a channel estimation of the propagation path (for example on the reverse link) and Minn expressly teaches the aspect that Wong assumes (the measurement of the reverse path and parameters to use to adapt the forward path).

A POSITA would have a motivation to combine Minn with Agee 923 for at least the following reasons: Both references use the same modulation techniques such as OFDM. Minn teaches the benefits of a particular form of channel measurement and Agee 923 is focused on such adjustments and the benefits and techniques of OFDM tone power management based on channel measurements. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions and Minn teaches a particular

form of measurement that would be benefitted by Agee 923's use of that measurement to improve downlink transmissions. Agee 923 provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in Minn by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of Minn to improve such transmissions. Agee 923 teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Minn to improve data transmissions.

A POSITA would have a motivation to combine Minn with Lehne for at least the following reasons: Both references use the same modulation techniques such as OFDM. Minn references the benefits of certain measurement forms for characterizing the channel based on uplink signals and Lehne further teaches such adjustments and the benefits and techniques of such adjustments to the downlink transmissions. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Lehne provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in Wong by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of Minn to improve such transmissions and the channel estimations used for the transmissions. Lehne teaches the benefits of using known identifiable training sequences to assist

in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Minn to improve data transmissions.

A POSITA would have a motivation to combine Minn with Yeh for at least the following reasons: Both references use the same modulation techniques such as OFDM. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Yeh identifies and provides specific improvements for the channel estimation in an OFDM system that a POSITA would recognize as further improving the goals of Minn to measure the uplink. Yeh specifically identifies the benefits of using a time domain measurement converted to a frequency domain parameter for estimating the channel characteristics to use for downlink transmissions which matches Minn's goal. Yeh teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Minn to improve data transmissions.

A POSITA would have a motivation to combine Minn with Yamamoto for at least the following reasons: As noted in the chart E-08, the Examiner already determined that Yeh either discloses, or renders obvious by itself, all of the elements of the asserted '369 claims except for the passage regarding "where said modifying includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal" and the '369 applicant did not challenge and acquiesced in such determination. Yamamoto provides a method for channel estimation using a time delay converted into a forward path frequency channel parameter used to adjust the forward path with the technique being a recognized improvement for Minn's method of doing the same measurement. Yamamoto provides an express teaching of using an identifiable training sequence (of a known signal) to

measure the reverse path for calculating an adjustment (predistortion) factor to be applied to the forward path transmissions and a POSITA would recognize the benefits of the usage of such a training sequence for the reasons stated in the Training Data sequence above and that those benefits would apply to the system in Minn to improve the downlink transmissions therein.

A POSITA would have a motivation to combine Minn with Litva for at least the following reasons: Both references use the same modulation techniques such as OFDM. This reference teaches the benefits of adjusting the downlink data transmissions and Litva further teaches such adjustments and the benefits and techniques of such adjustments to the downlink transmissions. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Litva provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in this reference by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of this reference to improve such transmissions. Litva teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in this reference to improve data transmissions.

As noted above, Minn can be combined with one or two of the references above. Without prejudice to any other combinations, Defendants identify specifically the following combinations:

- Minn with one of Li 748, Li 827, Agee 923, Wong, Lehne, Yeh, or Yamamoto
- Minn with one of the Channel Estimation and one of the Antenna Array references above

- Minn with one of the Channel Estimation and one of the OFDM Tone Modification references above
- Minn with one of the Channel Estimation and one of the Training Data references above
- Minn with one of the Channel Estimation and one of the QPSK Usage references above
- Minn with one of the OFDM Tone Modification and one of the Antenna Array references above
- Minn with one of the OFDM Tone Modification and one of the Training Data references above
- Minn with one of the OFDM Tone Modification and one of the QPSK Usage references above
- Minn with one of the Antenna Array and one of the QPSK Usage references above

- Minn combined with Li 748 and one of Agee 923 or Lehne or Litva
- Minn combined with Li 748 and Wong
- Minn combined with Li 748 and one of Agee 923 or Li 827
- Minn combined with Li 748 and one of Agee 923 or Yamamoto

- Minn combined with Li 827 and one of Agee 923 or Lehne or Litva
- Minn combined with Li 827 and one of Agee 923 or Yamamoto

- Minn combined with Agee 923 and Lehne
- Minn combined with Agee 923 and Wong
- Minn combined with Agee 923 and one of Yamamoto or Li 827

- Minn combined with Wong and one of Agee 923 or Lehne or Litva
- Minn combined with Wong and one of Li 827 or Li 748

- Minn combined with Yamamoto and one of Agee 923 or Lehne or Litva
- Minn combined with Yamamoto and Wong and Lehne

The motivations to combine such references with a reasonable expectation of success are detailed in the passages above.

To the extent Yeh does not anticipate and/or render obvious on its own any of the ‘369 claims, a person of ordinary skill in the art would have been motivated to combine Yeh with one or two of the following other references, for the reasons noted in the chart below, as well as for the reasons described throughout this Section with a reasonable expectation of success:

A POSITA would have a motivation to combine Yeh with Li 748 for at least the following reasons: Both references relate to the same technology and use the same equipment and terminology. Both references describe measuring the channel conditions and using the reverse path signal to calculate a parameter to adjust the forward path (downlink) transmissions including by adjusting the power levels of one or more OFDM tones. Yeh teaches using certain techniques to measure the channel characteristics and Li 748 is focused on such adjustments and the benefits and techniques of OFDM tone power management based on channel characteristic measurement.

A POSITA would have a motivation to combine Yeh with Li 827 for at least the following reasons: Yeh teaches using certain techniques to measure the channel characteristics and Li 827 is focused on such adjustments and the benefits and techniques of OFDM tone power management based on channel characteristic measurement.. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Both references use the same modulation techniques such as OFDM.

A POSITA would have a motivation to combine Yeh with Wong for at least the following reasons: Both references use the same modulation techniques such as OFDM. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Yeh identifies and provides specific improvements for the channel estimation in an OFDM system that a POSITA would recognize as further improving the goals of Wong to provide improved transmissions on the forward link. Yeh specifically identifies the benefits of using a time domain measurement converted to a frequency domain parameter for estimating the channel characteristics to use for downlink transmissions and Wong provides an effective use of such beneficial calculations to improve the downlink transmissions. Yeh expressly focuses on the channel estimation of the propagation path (for example on the reverse link) and

Yeh expressly teaches the aspect that Wong assumes (the measurement of the reverse path and parameters to use to adapt the forward path). Wong teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Yeh to improve data transmissions.

A POSITA would have a motivation to combine Yeh with Minn for at least the following reasons: Both references use the same modulation techniques such as OFDM. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Minn identifies and provides specific improvements for the channel estimation that a POSITA would recognize as further improving the goals of Yeh. Minn specifically identifies the benefits of using a time domain measurement converted to a frequency domain parameter for estimating the channel characteristics to use for downlink transmissions. Minn teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Yeh to improve data transmissions.

A POSITA would have a motivation to combine Yeh with Lehne for at least the following reasons: Both references use the same modulation techniques such as OFDM. Yeh teaches using certain techniques to measure the channel characteristics and Lehne further teaches such adjustments and the benefits and techniques of such adjustments to the downlink transmissions based on such measurements. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Lehne provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits

to the system and antennas referenced in Yeh by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of Yeh to improve such transmissions. Lehne teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Yeh to improve data transmissions.

A POSITA would have a motivation to combine Yeh with Agee 923 for at least the following reasons: Both references use the same modulation techniques such as OFDM. Yeh teaches using certain techniques to measure the channel characteristics and Agee 923 is focused on such adjustments and the benefits and techniques of OFDM tone power management based on channel characteristic measurement.. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Agee 923 provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in Yeh by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of Yeh to improve such transmissions. Agee 923 teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Yeh to improve data transmissions.

A POSITA would have a motivation to combine Yeh with Yamamoto for at least the following reasons: As noted in the chart E-08, the Examiner already determined that Yeh either discloses, or renders obvious by itself, all of the elements of the asserted '369 claims except for

the passage regarding “where said modifying includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal” and the ‘369 applicant did not challenge and acquiesced in such determination. Yeh provides a system similar to Yamamoto allowing for adjustment of downlink transmissions based upon signals on the reverse/uplink path. Yamamoto provides a method for channel estimation using a time delay converted into a forward path frequency channel parameter used to adjust the forward path with the technique being a recognized improvement for Yeh’s method of doing the same adjustment. Yamamoto provides an express teaching of using an identifiable training sequence (of a known signal) to measure the reverse path for calculating an adjustment (predistortion) factor to be applied to the forward path transmissions and a POSITA would recognize the benefits of the usage of such a training sequence for the reasons stated in the Training Data sequence above and that those benefits would apply to the system in Yeh.

A POSITA would have a motivation to combine Yeh with Litva for at least the following reasons: Both references use the same modulation techniques such as OFDM. This reference teaches the benefits of adjusting the downlink data transmissions and Litva further teaches such adjustments and the benefits and techniques of such adjustments to the downlink transmissions.

Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Litva provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in this reference by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further

improves the goal of this reference to improve such transmissions. Litva teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in this reference to improve data transmissions.

As noted above, Yeh can be combined with one or two of the references above. Without prejudice to any other combinations, Defendants identify specifically the following combinations:

- Yeh with one of Li 748, Li 827, Agee 923, Minn, Lehne, Wong, or Yamamoto
- Yeh with one of the Channel Estimation and one of the Antenna Array references above
- Yeh with one of the Channel Estimation and one of the OFDM Tone Modification references above
- Yeh with one of the Channel Estimation and one of the Training Data references above
- Yeh with one of the Channel Estimation and one of the QPSK Usage references above
- Yeh with one of the OFDM Tone Modification and one of the Antenna Array references above
- Yeh with one of the OFDM Tone Modification and one of the Training Data references above
- Yeh with one of the OFDM Tone Modification and one of the QPSK Usage references above
- Yeh with one of the Antenna Array and one of the QPSK Usage references above

- Yeh combined with Li 748 and one of Agee 923 or Lehne or Litva
- Yeh combined with Li 748 and Wong
- Yeh combined with Li 748 and one of Agee 923 or Li 827
- Yeh combined with Li 748 and one of Agee 923 or Yamamoto

- Yeh combined with Li 827 and one of Agee 923 or Lehne or Litva
- Yeh combined with Li 827 and Wong
- Yeh combined with Li 827 and one of Agee 923 or Yamamoto

- Yeh combined with Agee 923 and Lehne
- Yeh combined with Agee 923 and Wong
- Yeh combined with Agee 923 and one of Yamamoto or Li 827

- Yeh combined with Wong and one of Agee 923 or Lehne or Litva
- Yeh combined with Wong and one of Li 827 or Li 748

- Yeh combined with Yamamoto and one of Agee 923 or Lehne or Litva
- Yeh combined with Yamamoto and Wong

The motivations to combine such references with a reasonable expectation of success are detailed in the passages above.

To the extent Yamamoto does not anticipate and/or render obvious on its own any of the ‘369 claims, a person of ordinary skill in the art would have been motivated to combine Yamamoto with one or two of the following other references, for the reasons noted in the chart below, as well as for the reasons described throughout this Section with a reasonable expectation of success:

A POSITA would have a motivation to combine Yamamoto with Li 748 for at least the following reasons: Both references relate to the same technology and use the same equipment and terminology. As conceded by the applicant during prosecution, Yamamoto teaches all of the elements of the asserted claims except for the last clause of claim 1 regarding modification of power for OFDM tones and Li 748 teaches that specific element which would be an improvement to Yamamoto and merely a design choice when using OFDM as the transmission technique.

A POSITA would have a motivation to combine Yamamoto with Li 827 for at least the following reasons: As conceded by the applicant during prosecution, Yamamoto teaches all of the elements of the asserted claims except for the last clause of claim 1 regarding modification of power for OFDM tones and Li 827 teaches that specific element which would be an improvement to Yamamoto and merely a design choice when using OFDM as the transmission technique. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions.

A POSITA would have a motivation to combine Yamamoto with Wong for at least the following reasons: As noted in the chart E-08, the Examiner already determined that Yeh either

discloses, or renders obvious by itself, all of the elements of the asserted '369 claims except for the passage regarding "where said modifying includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal" and the '369 applicant did not challenge and acquiesced in such determination. Wong teaches the exact element allegedly missing in Yamamoto in the context of a system very similar to Yamamoto for the same goal of improving downlink transmissions from a base station to a remote terminal. Wong provides a system similar to Yamamoto allowing for adjustment of downlink transmissions based upon signals on the reverse/uplink path. Yamamoto provides a method for channel estimation using a time delay converted into a forward path frequency channel parameter used to adjust the forward path with the technique being a recognized improvement for Wong's method of doing the same adjustment. Yamamoto provides an express teaching of using an identifiable training sequence (of a known signal) to measure the reverse path for calculating an adjustment (predistortion) factor to be applied to the forward path transmissions and a POSITA would recognize the benefits of the usage of such a training sequence for the reasons stated in the Training Data sequence above and that those benefits would apply to the system in Wong to improve the downlink transmissions therein.

A POSITA would have a motivation to combine Yamamoto with Minn for at least the following reasons: Both references use the same modulation techniques such as OFDM. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Minn identifies and provides specific improvements for the channel estimation that a POSITA would recognize as further improving the goals of Yamamoto. Minn specifically identifies the benefits of using a time domain measurement converted to a frequency domain parameter for estimating the channel characteristics to use for

downlink transmissions. Minn teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Yamamoto to improve data transmissions. Yamamoto expressly focuses on the adaptation of the downlink transmissions given a channel estimation of the propagation path (for example on the reverse link).

A POSITA would have a motivation to combine Yamamoto with Lehne for at least the following reasons: Both references use the same modulation techniques. Yamamoto references the benefits of adjusting the downlink data transmissions and Lehne further teaches such adjustments and the benefits and techniques of such adjustments to the downlink transmissions. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Lehne provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in Yamamoto by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of Yamamoto to improve such transmissions. Lehne teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Yamamoto to improve data transmissions.

A POSITA would have a motivation to combine Yamamoto with Yeh for at least the following reasons: Both references use the same modulation techniques such as OFDM. Both references address the benefits and use of channel estimation based on reverse path data signals to

adapt the forward path data transmissions. Yeh identifies and provides specific improvements for the channel estimation in an OFDM system that a POSITA would recognize as further improving the goals of Yamamoto to provide improved transmissions on the forward link. Yeh specifically identifies the benefits of using a time domain measurement converted to a frequency domain parameter for estimating the channel characteristics to use for downlink transmissions. Yeh teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Yamamoto to improve data transmissions.

A POSITA would have a motivation to combine Yamamoto with Agee 923 for at least the following reasons: Yamamoto references the benefits of adjusting the downlink data transmissions including through the use of OFDM tone level power adjustments and Agee 923 is focused on such adjustments and the benefits and techniques of OFDM tone power management. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Agee 923 provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in Yamamoto by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of Yamamoto to improve such transmissions. Agee 923 teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in Yamamoto to improve data transmissions. As conceded by the applicant during prosecution, Yamamoto teaches all of the

elements of the asserted claims except for the last clause of claim 1 regarding modification of power for OFDM tones and Agee 923 teaches that specific element which would be an improvement to Yamamoto and merely a design choice when using OFDM as the transmission technique.

A POSITA would have a motivation to combine Yamamoto with Litva for at least the following reasons: Both references use the same modulation techniques such as OFDM. This reference teaches the benefits of adjusting the downlink data transmissions and Litva further teaches such adjustments and the benefits and techniques of such adjustments to the downlink transmissions. Both references address the benefits and use of channel estimation based on reverse path data signals to adapt the forward path data transmissions. Litva provides teachings regarding the well-known technologies for the use of antenna arrays, including multiple antennas, antenna pointing techniques, phased arrays, determination of the spatial direction for transmissions, and beamforming techniques, that a POSITA would recognize as providing benefits to the system and antennas referenced in this reference by providing specific improvements in the wireless transmission path between the base station and the remote units which corresponds to and further improves the goal of this reference to improve such transmissions. Litva teaches the benefits of using known identifiable training sequences to assist in calculating the channel estimation which a POSITA would recognize would benefit the techniques in this reference to improve data transmissions.

As noted above, Yamamoto can be combined with one or two of the references above. Without prejudice to any other combinations, Defendants identify specifically the following combinations:

- Yamamoto with one of Li 748, Li 827, Agee 923, Minn, Lehne, Yeh, or Wong

- Yamamoto with one of the Channel Estimation and one of the Antenna Array references above
- Yamamoto with one of the Channel Estimation and one of the OFDM Tone Modification references above
- Yamamoto with one of the Channel Estimation and one of the Training Data references above
- Yamamoto with one of the Channel Estimation and one of the QPSK Usage references above
- Yamamoto with one of the OFDM Tone Modification and one of the Antenna Array references above
- Yamamoto with one of the OFDM Tone Modification and one of the Training Data references above
- Yamamoto with one of the OFDM Tone Modification and one of the QPSK Usage references above
- Yamamoto with one of the Antenna Array and one of the QPSK Usage references above

- Yamamoto combined with Li 748 and one of Agee 923 or Lehne or Litva
- Yamamoto combined with Li 748 and one of Minn or Yeh
- Yamamoto combined with Li 748 and one of Agee 923 or Li 827
- Yamamoto combined with Li 748 and Wong

- Yamamoto combined with Li 827 and one of Agee 923 or Lehne or Litva
- Yamamoto combined with Li 827 and one of Minn or Yeh
- Yamamoto combined with Li 827 and one of Agee 923 or Wong

- Yamamoto combined with Agee 923 and Lehne
- Yamamoto combined with Agee 923 and one of Li 827 or Li 748
- Yamamoto combined with Agee 923 and Wong

- Yamamoto combined with Wong and one of Agee 923 or Lehne or Litva
- Yamamoto combined with Wong and one of Li 827 or Li 748

- Yamamoto combined with Yeh and one of Agee 923 or Lehne or Litva
- Yamamoto combined with Yeh and Wong
- Yamamoto combined with Yeh and one of Li 827 or Li 748

- Yamamoto combined with Wong and one of Agee 923 or Lehne or Litva
- Yamamoto combined with Wong and one of Minn or Yeh

The motivations to combine such references with a reasonable expectation of success are detailed in the passages above.

To the extent Keller does not anticipate and/or render obvious on its own any of the ‘369 claims, a person of ordinary skill in the art would have been motivated to combine Keller with one or both of the following other references, for the reasons noted in the chart below, as well as for the reasons described throughout this Section with a reasonable expectation of success:

A POSITA would have a motivation to combine Keller with Minn for at least the following exemplary reasons: First, a POSITA would understand that Keller discloses “preequalization for the OFDM modem” at a “base station” based upon “adapting the subcarrier power to the inverse of the channel transfer function” wherein the “estimate of the channel transfer function \widehat{H}_n ” is “acquired by means of pilot-tone based channel estimation” as “monitored based on the received OFDM symbols” in the “up-link” for “Adaptation of the transmission parameters” in “the forthcoming TDMA/time-division duplex (TDD) duplex timeslot” (such as IEEE 802.11a at the time of the alleged invention of the ‘369 Patent). However, a POSITA implementing an OFDM preequalization method based on Keller would understand that while Keller provides at least one methodology for determining such “estimate of the channel transfer function \widehat{H}_n ” as discussed above, Keller also observes that “Different techniques can be employed to estimate the channel quality.” Thus, a POSITA would have been specifically motivated to find an optimal methodology by which such “estimate of the channel transfer function \widehat{H}_n ” would be “acquired by means of pilot-tone based channel estimation” as “monitored based on the received OFDM symbols” in the “up-link”. A POSITA would understand that Minn discloses methods for how Keller’s “base station” can determine an “estimate of the channel transfer function \widehat{H}_n ” that is “acquired by means of pilot-tone based channel estimation” as “monitored based on the received OFDM symbols” in the “up-link” at least in the form of the “Most Significant Taps Approach (MST)” or the “MST dual form DFT-based method” as a “time-domain based channel estimation for OFDM system.”

Accordingly, a POSITA would have been motivated to consider the “Most Significant Taps Approach (MST)” or the “MST dual form DFT-based method” as a “time-domain based channel estimation for OFDM system” of Minn as a solution to the problem of how the “base station” can determine an “estimate of the channel transfer function \widehat{H}_n ” that is “acquired by means of pilot-tone based channel estimation” as “monitored based on the received OFDM symbols” in the “up-link” when implementing an OFDM preequalization method based upon the teaching of Keller for the specific case of “the received OFDM symbols”.

Second, Keller discloses a “preequalization for the OFDM modem” at a “base station” based upon “adapting the subcarrier power to the inverse of the channel transfer function” for “frequency-selective fading of the time-dispersive channel” due to “multipath propagation”. Minn discloses a methodology for determining such “channel transfer function” of “received OFDM symbols” in the “up-link” over “frequency-selective fading of the time-dispersive channel” due to “multipath propagation” as needed in Keller. Minn also discloses that its teachings are directed specifically to “Orthogonal frequency division multiplexing (OFDM)” with “adaptive modulation and power allocation across the subcarriers according to the channel conditions.” Thus, Minn provides a solution to the problem faced by Keller (i.e. how to determine an “estimate of the channel transfer function \widehat{H}_n ” that is “acquired by means of pilot-tone based channel estimation” as “monitored based on the received OFDM symbols” in the “up-link”), and Minn teaches applicability of its solutions to OFDM with “adaptive modulation and power allocation across the subcarriers according to the channel conditions.”

A POSITA would have understood that when most significant taps approach (MST) or MST dual form DFT-based method of Minn could be applied to the “up-link” at a “base station” over the “frequency-selective fading of the time-dispersive channel” due to “multipath

propagation” of Keller, such that “identifying at least one multipath transmission delay” is specifically disclosed as being “within a reverse path data signal received from a receiving device”.

A POSITA would have further understood that determining the “preequalization function E_n ” as the “inverse” of such “estimated channel transfer function” as disclosed in Keller from the amplitude or magnitude of the “channel frequency response estimate” in Minn is thus also disclosed as being “based on said at least one transmission delay.”

A POSITA would have a motivation to combine Keller with Lehne for at least the following exemplary reasons: First, the disclosures of Keller are directed to “dramatically improve the performance of an OFDM system” including its “throughput”, and Keller also discloses that “Combining adaptive antenna techniques with OFDM” leads to “suppressing cochannel interference”, because the prior art teaches that combining “OFDM” as used in Keller with “antenna diversity” as used in Lehne would “increase data throughput”, and because Lehne also teaches that “adaptive antennas” enable “lowering the interference level.” Thus, a POSITA would have been motivated to combine the “adaptive antennas” disclosures of Lehne with the “preequalizing the down-link OFDM” at a “base station” in a in a “wireless communications channel” subject to “multipath propagation” of Keller in order to even further “increase data throughput” and lower the “interference” for the combination.

Second, a POSITA would have an expectation of success when combining the “smart or adaptive antenna” disclosures of Lehne with the “preequalizing the down-link OFDM” at a “base station” in a in a “wireless communications channel” subject to “multipath propagation” of Keller. For example, a POSITA would have known that the output of the “Lobe forming unit” in the “Reception part of a smart antenna” of Lehne is analogous to the disclosure of “up-link” in the “base station” of Keller, and that the input to the “Lobe forming unit” in the “Transmission part of

a smart antenna” of Lehne is analogous to the disclosure of “down-link” in the “base station” of Keller. Thus, a POSITA would have known that the “smart or adaptive antenna” system of Lehne can be substituted for the ““dumb”/fixed antenna” that is effectively assumed by the disclosures of Keller unless otherwise “Combining adaptive antenna techniques with OFDM transmissions.”

Moreover, a POSITA would have known that prior art “smart or adaptive antenna” approaches are applicable to an “OFDM” form of “cellular communications system” because “OFDM” provides “Spectral diversity” that is “effective when the fading is frequency-selective”, which a POSITA would associate with Keller, while “spatial diversity can be used to provide substantial improvement in system performance” through the use of “multiple antennas sufficiently well-separated” even for “situations where the fading channel is nonselective,” thereby teaching a POSITA that the combination of Keller and Lehne as described above would be even more reliable across all channel conditions (both “frequency-selective” and “nonselective”) than either Keller or Lehne alone.

Third, a POSITA would understand from the disclosure of Lehne that all “smart antenna” approaches of Lehne are applicable to the combination of Keller, whether also in combination with Minn or otherwise, in view of Lehne.

As noted above, Keller can be combined with one or both of the references above. Without prejudice to any other combinations, Defendants identify specifically the following combinations:

- Keller with Minn
- Keller with Lehne
- Keller with Minn and Lehne
- Keller with Agee 923
- Keller with Agee 923 and Minn
- Keller with Agee 923 and Lehne
- Keller with Agee 923, Minn, and Lehne

C. P.R. 3-3(c) Disclosures: Charts Identifying Where in Each Item of Prior Art Each Element of the Asserted Claim Is Found

Exhibits A-01 et seq., B-01 et seq., C-01 et seq., D-01 et seq., and E-01 et seq., of these contentions are charts that specifically identify where each element of each Asserted Claim is found in the prior art. The claim charts in these contentions (Exhibits A-01 et seq., B-01 et seq., C-01 et seq., D-01 et seq., and E-01 et seq.) provide example sections within the prior art references that teach or suggest each and every element of the assert claims either expressly or inherently. The contentions set forth obviousness arguments based on the disclosures in each of the references, teachings well known at the time of filing, admitted prior art, and the knowledge of a person of ordinary skill in the art at the time the respective patent application was filed. If needed, all of the exhibited art can be used in combination for an obvious determination.

For Asserted Claims governed by 35 U.S.C. §112 ¶ 6, the exhibits include identity of structure(s), act(s), or materials in each prior art reference that performs the claimed function. To the extent any limitation of any of the Asserted Claims is construed to have a similar meaning, or to encompass similar feature(s) and function(s), as apparently contended by XR in its Infringement Contentions, or later determined by the Court, and to the extent at least one claim chart in Exhibits A-01 et seq., B-01 et seq., C-01 et seq., D-01 et seq., and E-01 et seq., identifies any prior art reference, or a portion thereof, as disclosing or teaching such similarly construed claim limitation, such identified prior art reference, or the portion thereof, and Defendants' contentions with respect to such claim limitation and such prior art reference as found in such claim chart, are incorporated by reference, and are part of, Defendants' invalidity contentions with respect to each of the Asserted Claims that includes such similarly construed claim limitation.

D. P.R. 3-4(d) Disclosures: Invalidity Under 35 U.S.C. § 112

Pursuant to Local Rule 3-3(d), Defendants contend that certain claims of the Asserted Patents are invalid under 35 U.S.C. § 112 because: (1) the claims are indefinite; (2) the claims are not enabled; and/or (3) the claims lack adequate written description. Defendants' contentions that the following claims are invalid under 35 U.S.C. § 112 are made in the alternative, and do not constitute, and should not be interpreted as, admissions regarding the construction or scope of the claims of the Asserted Patents, or that any of the claims of the Asserted Patents are not anticipated or rendered obvious by any prior art.

These contentions are based on Defendants' current understanding of XR's Infringement Contentions. To the extent XR contends that the prior art references identified above would not enable a person of ordinary skill to make or use the elements of the Asserted Claims against which they are cited, or to the extent XR contends that the Asserted Claims cover something different from what Defendants understands them to cover, the Asserted Claims do not comply with the enablement, written description, and/or definiteness requirements of 35 U.S.C. § 112 ¶¶ 1 & 2. A more detailed basis for Defendants' indefiniteness, enablement, and/or written description defenses will be set forth in Defendants' expert reports on invalidity and/or in Motion[s] for Summary Judgment of Invalidity, to be served in accordance with the Court's Docket Control Order. Defendants have not taken any depositions related to these issues and discovery is on-going. Defendants specifically reserve the right to amend and/or supplement these contentions based on further developments in the case in accordance with the Court's Rules or as otherwise authorized by the Court.

The written description and enablement requirements are analyzed by comparing the claims with the disclosure in the specification. If the claimed invention does not appear in the specification, the claim fails regardless of whether one of skill in the art could make or use the

claimed invention. *See, e.g., Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1348 (Fed. Cir. 2010). To satisfy the enablement requirement, a patentee must “describe the manner and process of making and using the invention so as to enable a person of skill in the art to make and use the full scope of the invention without undue experimentation.” *See, e.g., LizardTech, Inc. v. Earth Res. Mapping, Inc.*, 424 F.3d 1336, 1344-45 (Fed. Cir. 2005). To satisfy the written description requirement, the patentee must convey to those skilled in the art that, as of the filing date, the applicant was in possession of the invention, and demonstrate that possession by disclosing the invention in the specification. *See, e.g., Ariad*, 598 F.3d at 1352. A patent must also be precise enough to afford clear notice to what is claimed. *Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120, 2124 (2014). A patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. *Id.* The standard for assessing if a patent claim is sufficiently definite to satisfy the statutory requirement is whether “one skilled in the art would understand the bounds of the claim when read in light of the specification.” *See Novo Indus., L.P. v. Micro Molds Corp.*, 350 F.3d 1348, 1358 (Fed. Cir. 2003). Claims that depend from claims that are invalid for lack of enablement or written description support inherit the deficiencies of the claims from which they depend and are also invalid.

A claim term can be indefinite based on multiple grounds ranging from the substantive concerns to unresolvable drafting errors, each of which can be fatal to the validity of the claims as a matter of law. For example, the Federal Circuit has repeatedly held that apparatus claims that contain method claim limitations are indefinite because it is impossible to determine when direct infringement occurs. *See, e.g., Rembrandt Data Techs., LP v. AOL, LLC*, 641 F.3d 1331, 1339-40 (Fed. Cir. 2011) (an independent claim that recited both an apparatus and a method of using that

apparatus was indefinite, as was its dependent claims); *IPXL Holdings v. Amazon.com*, 430 F.3d 1377, 1384 (Fed. Cir. 2005); *In re Katz Interactive Call Processing Patent Litigation*, 639 F.3d 1303, 1318 (Fed. Cir. 2023) (mixed claims “create confusion as to when direct infringement occurs because they are directed both to systems and to actions performed by” users). Claim terms that lack antecedent basis are indefinite. *See, e.g., Allen Eng’g Corp. v. Bartell Indus., Inc.*, 299 F.3d 1336, 1348-49 (Fed. Cir. 2002) (claim ending in the middle of a claim limitation was indefinite because it was “impossible to discern the scope of such a truncated limitation”). Furthermore, means-plus-function claims, which invoke 35 U.S.C. § 112 ¶6, may be invalid as indefinite where a patent owner has failed to disclose adequate corresponding structure linked to the recited claim functionality. *Noah Sys., Inc. v. Intuit Inc.*, 675 F.3d 1302, 1311-12 (Fed. Cir. 2012).

In the Supreme Court’s decision in *Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120, 2124 (2014), the Court clarified that a patent is invalid “for indefiniteness if its claims read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention.” *See Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120, 2124 (2014). “[I]t cannot be sufficient that a court can ascribe some meaning to a patent’s claim; the definiteness inquiry trains on the understanding of a skilled artisan at the time of the patent application, not that of a court viewing matters post hoc.” *Id.* at 2130. The definiteness inquiry necessarily demands that the “patent and prosecution history disclose a single known approach or establish that, where multiple known approaches exist, a person of ordinary skill in the art would know which approach to select.” *Id.* Claims that depend from claims that are indefinite inherit the indefiniteness of the claims from which they depend and are also indefinite.

The Asserted Claims of the Asserted Patents are invalid because the Asserted Patents do not include sufficient written description of the purported inventions claimed therein, and of the manner and process of making and using said inventions, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which the inventions pertain, or which they are most nearly connected, to make and use any of the claimed inventions. 35 U.S.C. § 112 ¶1.

Defendants contend that the specifications to which priority is sought fail to describe the full scope of the claimed inventions in sufficient detail such that one skilled in the art could reasonably conclude that the inventor had possession of the claimed invention as of the filing dates to which the Asserted Patents claim priority. The specifications of the Asserted Patents fail to describe the claimed inventions in a manner understandable to one of ordinary skill in the art and fail to show that the listed inventors actually invented the claimed inventions. Accordingly, each of the Asserted Claims is invalid for lack of adequate written description under 35 U.S.C. § 112 ¶1.

In addition, Defendants contend that, at the time of XR's claimed priority date, the patent applications to which XR claims priority did not enable one of ordinary skill in the art to make and use the full scope of the claimed inventions without undue experimentation. Accordingly, each of the Asserted Claims is invalid for lack of enablement under 35 U.S.C. § 112 ¶1.

Defendants also contend that the Asserted Claims fail to particularly point out and distinctly claim the subject matter that the listed inventor regarded as his invention. Defendants contend that one of ordinary skill in the art would not understand the scope of each of the Asserted Claims when the claim is read in light of the specification. Accordingly, each of the Asserted Claims is invalid for indefiniteness under 35 U.S.C. § 112, ¶1.

Defendants contend that XR’s apparent claim interpretations render the Asserted Claims overly broad in scope and well beyond the purported inventions described in the Asserted Patents. XR is attempting to interpret the Asserted Claims in an idiosyncratic manner that is entirely inconsistent with the written specification and prosecution history of the Asserted Patents as well as with the understanding of one of ordinary skill in the art at the time the applications that issued as the Asserted Patents were filed. These allegations are inconsistent with the plain language of the claims, the supporting description, and the prosecution history.

Defendant provides below an identification of terms in Asserted Claims that render the Asserted Claims, at least as apparently construed by XR in its Infringement Contentions as discussed above, invalid pursuant to 35 U.S.C. § 112 as not enabled or lacking sufficient written description.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
'235 Patent: Claim 1	“a transceiver operatively coupled to the antenna and configured to transmit and receive electromagnetic signals using the antenna”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'235 Patent: Claims 1 and 15	“a processor operatively coupled to the transceiver”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'235 Patent: Claim 1	“a processor operatively coupled to the transceiver, the processor configured to: receive a first signal transmission from a remote station via the first antenna element and a second signal transmission from the remote station via the second antenna element simultaneously;	<p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.</p> <p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 2 because the claim does not distinctly and particularly point out the invention.</p> <p>This claim limitation is subject to 35 U.S.C. § 112, ¶ 6, and is invalid under 35 U.S.C. § 112, ¶ 2 because the specification does not disclose corresponding structure linked to the claimed</p>

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	<p>determine first signal information for the first signal transmission;</p> <p>determine second signal information for the second signal transmission, wherein the second signal information is different than the first signal information;</p> <p>determine a set of weighting values based on the first signal information and the second signal information, wherein the set of weighting values is configured to be used by the transceiver to construct one or more beam-formed transmission signals;</p> <p>cause the transceiver to transmit a third signal to the remote station via the antenna, the third signal comprising content based on the set of weighting values.”</p>	function.
'235 Patent: Claim 1	“receive a first signal transmission from a remote station via the first antenna element and a second signal transmission from the remote station via the second antenna element simultaneously”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'235 Patent: Claim 1	“determine a set of weighting values based on the first signal	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	information and the second signal information, wherein the set of weighting values is configured to be used by the transceiver to construct one or more beam-formed transmission signals”	claims.
’235 Patent: Claim 1	“cause the transceiver to transmit a third signal to the remote station via the antenna, the third signal comprising content based on the set of weighting values”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’235 Patent: Claim 2	“wherein the first signal transmission and the second signal transmission comprise electromagnetic signals comprising one or more transmission peaks and one or more transmission nulls”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’235 Patent: Claim 3	“wherein the first signal transmission and the second signal transmission are directional transmissions”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’235 Patent: Claim 4	“wherein the content comprises data configured to be used by the remote station to modify the placement of one or more transmission peaks and one or more transmission nulls in a subsequent signal transmission”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’235 Patent: Claim 5	“wherein the set of weighting values is further based on one or more of: a transmit power	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	level, a data transmit rate, an antenna direction, quality of service data, or timing data”	
’235 Patent: Claim 8	“receiving a first signal transmission from a remote station via a first antenna element of an antenna and a second signal transmission from the remote station via a second antenna element of the antenna simultaneously, wherein the first signal transmission and the second signal transmission comprise electromagnetic signals comprising one or more transmission peaks and one or more transmission nulls”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’235 Patent: Claim 8	“determining a set of weighting values based on the first signal information and the second signal information, wherein the set of weighting values is configured to be used by the remote station to construct one or more beam-formed transmission signals”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’235 Patent: Claim 8	“transmitting to the remote station a third signal comprising content based on the set of weighting values”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’235 Patent: Claim 9	“transmitting the third signal to the remote station via the antenna”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
'235 Patent: Claim 10	“wherein the first signal transmission and the second signal transmission are directional transmissions”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'235 Patent: Claim 11	“wherein the set of weighting values is further based on one or more of: a transmit power level, a data transmit rate, an antenna direction, quality of service data, or timing data”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'235 Patent: Claim 12	“wherein the content comprises data configured to be used by the remote station to modify the placement of one or more transmission peaks and one or more transmission nulls in a subsequent signal transmission”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'235 Patent: Claim 15	“a processor operatively coupled to the transceiver, the processor configured to: receive a first signal transmission from a remote station via the antenna, the first signal transmission comprising first signal information, wherein the first signal information comprises one or more of: a transmit power level, a data transmit rate, an antenna direction, quality of service data, or timing data; receive a second signal	<p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.</p> <p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 2 because the claim does not distinctly and particularly point out the invention.</p> <p>This claim limitation is subject to 35 U.S.C. § 112, ¶ 6, and is invalid under 35 U.S.C. § 112, ¶ 2 because the specification does not disclose corresponding structure linked to the claimed function.</p>

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	transmission from the remote station via the antenna, the second signal transmission comprising second signal information; determine a set of weighting values based on the first signal information and the second signal information, wherein the set of weighting values is configured to be used by the transceiver to construct one or more beam-formed transmission signals; cause the transceiver to generate a third signal comprising content based on the set of weighting values.”	
'235 Patent: Claim 15	“receive a first signal transmission from a remote station via the antenna, the first signal transmission comprising first signal information, wherein the first signal information comprises one or more of: a transmit power level, a data transmit rate, an antenna direction, quality of service data, or timing data;”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'235 Patent: Claim 15	“determine a set of weighting values based on the first signal information and the second signal information, wherein the set of weighting values is	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	configured to be used by the transceiver to construct one or more beam-formed transmission signals”	
’235 Patent: Claim 15	“cause the transceiver to generate a third signal comprising content based on the set of weighting values”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’235 Patent: Claim 16	“wherein the first signal transmission and the second signal transmission comprise electromagnetic signals comprising one or more transmission peaks and one or more transmission nulls”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’235 Patent: Claim 17	“wherein the processor is configured to receive a fourth signal transmission from an interferer source, the fourth signal transmission being undesired, and the processor is configured to store identifying information concerning the undesired interferer source and the remote station”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’235 Patent: Claim 18	“wherein the processor is configured to identify a further interferer signal transmission from the interferer source, and to identify a further desired signal transmission from the remote station, wherein the processor is further configured to prevent the transceiver from transmitting a fifth signal transmission via	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	the antenna during reception of the further desired signal transmission but to allow the transceiver to transmit a sixth signal transmission via the antenna during reception of the further interferer signal transmission”	
’235 Patent: Claim 19	“wherein the set of weighting values are applied to the third signal, and wherein the transceiver is configured to receive a fourth signal transmitted from the remote station, and the processor is configured to apply the set of weighting values to the fourth signal”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’939 Patent: Claims 15 and 30	“a wireless input/output (I/O) unit that is configured to establish a plurality of access points”	<p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.</p> <p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 2 because the claim does not distinctly and particularly point out the invention.</p> <p>This claim limitation is subject to 35 U.S.C. § 112, ¶ 6, and is invalid under 35 U.S.C. § 112, ¶ 2 because the specification does not disclose corresponding structure linked to the claimed function.</p>
’939 Patent: Claim 15:	“signal transmission/reception coordination logic that is capable of ascertaining, by monitoring the plurality of access points for received signals, that: a first access point of the	<p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.</p> <p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 2 because the claim does not distinctly and particularly point out the invention.</p>

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	<p>plurality of access points is receiving a first signal on a first channel, a second access point of the plurality of access points is receiving a second signal that is ongoing on a second channel, the signal transmission/reception coordination logic adapted to restrain at least a third access point of the plurality of access points from transmitting a third signal on a third channel responsive to the ascertaining that the first access point is receiving the first signal and that the second access point is receiving the second signal that is ongoing-on the second channel, wherein the restraining at least the third access point prevents degradation to the first and second signals”</p>	<p>This claim limitation is subject to 35 U.S.C. § 112, ¶ 6, and is invalid under 35 U.S.C. § 112, ¶ 2 because the specification does not disclose corresponding structure linked to the claimed function.</p>
<p>’939 Patent: Claim 15</p>	<p>“a second access point of the plurality of access points is receiving a second signal that is ongoing on a second channel, the signal transmission/reception coordination logic adapted to restrain at least a third access point of the plurality of access points from transmitting a third signal on a third channel responsive to the ascertaining that the first access point is receiving</p>	<p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.</p>

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	the first signal and that the second access point is receiving the second signal that is ongoing-on the second channel,”	
’939 Patent: Claim 15:	“wherein the restraining at least the third access point prevents degradation to the first and second signals”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’939 Patent: Claim 17	“wherein the prevented degradation to the first and second signals comprises interference”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’939 Patent: Claims 21 and 34	“wherein the signal received by the access point comprises at least a portion of an uplinked packet”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’939 Patent: Claims 22 and 35	“wherein the at least a portion of the uplinked packet comprises at least part of a preamble of the uplinked packet”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’939 Patent: Claim 30	“signal transmission/reception coordination logic that is capable of ascertaining, by monitoring the plurality of access points for received signals, that a first access point of the plurality of access points is receiving a first signal on a first channel and that is adapted to restrain at least a second access point of the plurality of access points from transmitting a second signal on a second channel different from the first channel responsive to the	<p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.</p> <p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 2 because the claim does not distinctly and particularly point out the invention.</p> <p>This claim limitation is subject to 35 U.S.C. § 112, ¶ 6, and is invalid under 35 U.S.C. § 112, ¶ 2 because the specification does not disclose corresponding structure linked to the claimed function.</p>

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	ascertaining that the first access point is receiving the first signal”	
'376 Patent: Claim 1	<p>“a processor configured to: generate a probing signal for transmission to at least a first client device and a second client device; generate a first data stream for transmission to the first client device; and generate a second data stream for transmission to the second client device; wherein . . . the processor . . . is further configured to: receive a first feedback information from the first client device in response to the transmission of the probing signal; receive a second feedback information from the second client device in response to the transmission of the probing signal; determine where to place transmission peaks and transmission nulls within one or more spatially distributed patterns of electromagnetic signals based in part on the first and the second feedback information; transmit the first data stream to the first client device via the one or more spatially distributed</p>	<p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.</p> <p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 2 because the claim does not distinctly and particularly point out the invention.</p> <p>This claim limitation is subject to 35 U.S.C. § 112, ¶ 6, and is invalid under 35 U.S.C. § 112, ¶ 2 because the specification does not disclose corresponding structure linked to the claimed function.</p>

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	patterns of electromagnetic signals; and transmit the second data stream to the second client device via the one or more spatially distributed patterns of electromagnetic signals; wherein transmission of the first data stream and transmission of at least part of the second data stream occur at the same time; and wherein the one or more spatially distributed patterns of electromagnetic signals are configured to exhibit a first transmission peak at a location of the first client device and a second transmission peak at a location of the second client device”	
’376 Patent: Claims 1, 12, 22, 32	“generate a probing signal for transmission to at least a first client device and a second client device”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claims 1, 12, 22, 32	“generate a first data stream for transmission to the first client device”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claims 1, 12, 22, 32	“generate a second data stream for transmission to the second client device”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claims 1, 12, 22, 32	“transmit the probing signal to at least the first client device and the second client device via a smart antenna”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
'376 Patent: Claim 1	"receive a first feedback information from the first client device in response to the transmission of the probing signal"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claim 1	"receive a second feedback information from the second client device in response to the transmission of the probing signal"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claim 1	"determine where to place transmission peaks and transmission nulls within one or more spatially distributed patterns of electromagnetic signals based in part on the first and the second feedback information"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claim 1	"transmit the first data stream to the first client device via the one or more spatially distributed patterns of electromagnetic signals"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claim 1	"transmit the second data stream to the second client device via the one or more spatially distributed patterns of electromagnetic signals"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claim 1	"wherein transmission of the first data stream and transmission of at least part of the second data stream occur at the same time"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claim 1	"wherein the one or more spatially distributed patterns of electromagnetic signals are configured to exhibit a first transmission peak"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	at a location of the first client device and a second transmission peak at a location of the second client device”	
’376 Patent: Claims 2, 13, 23,	“determine a first set of weights to apply to the one or more spatially distributed patterns of electromagnetic signals”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claims 3, 14, 25	“modify the one or more spatially distributed patterns of electromagnetic signals based on adjustment of a first set of weights to manipulate the one or more spatially distributed patterns of electromagnetic signals”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claims 4, 15, 26,	“transmit a third data stream to the first client device via the modified one or more spatially distributed patterns of electromagnetic signals”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claims 5, 16,	“determine a second set of weights to apply to the one or more spatially distributed patterns of electromagnetic signals, wherein the first set of weights and the second set of weights are different”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claims 6, 17, 29	“modify the one or more spatially distributed patterns of electromagnetic signals based on adjustment of a second set of weights to manipulate the one or more spatially distributed patterns of electromagnetic signals”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
'376 Patent: Claims 6, 17, 29	“transmit a third data stream to the second client device via the modified one or more spatially distributed patterns of electromagnetic signals”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claims 7, 18	“wherein the first feedback information and the second feedback information comprise at least one of: a transmit power level, a data receive rate, an antenna direction, quality of service data, a signal to noise ratio, a phase value, an amplitude value, a frequency value, timing data, or an index to a routing table”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claims 8,	“wherein the one or more spatially distributed patterns of electromagnetic signals are further configured to exhibit a first transmission null at a location of a third device”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claims 9,	“wherein the one or more spatially distributed patterns of electromagnetic signals are further configured to exhibit a second transmission null at a location of a fourth device”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claims 12, 22, 32	“receive a first feedback information from the first client device”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
'376 Patent: Claims 12, 22, 32	“receive a second feedback information from the second client device”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claim 12	<p>“a processor configured to: generate a probing signal for transmission to at least a first client device and a second client device; generate a first data stream for transmission to the first client device; and generate a second data stream for transmission to the second client device; wherein . . . the processor . . . is further configured to: receive a first feedback information from the first client device; receive a second feedback information from the second client device; determine where to place transmission peaks and transmission nulls within one or more spatially distributed patterns of electromagnetic signals based in part on the first and the second feedback information; transmit the first data stream to the first client device via the one or more spatially distributed patterns of electromagnetic signals;</p>	<p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.</p> <p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 2 because the claim does not distinctly and particularly point out the invention.</p> <p>This claim limitation is subject to 35 U.S.C. § 112, ¶ 6, and is invalid under 35 U.S.C. § 112, ¶ 2 because the specification does not disclose corresponding structure linked to the claimed function.</p>

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	and transmit the second data stream to the second client device via the one or more spatially distributed patterns of electromagnetic signals; wherein transmission of the first data stream and transmission of at least part of the second data stream occur at the same time; and wherein the one or more spatially distributed patterns of electromagnetic signals are configured to exhibit a first transmission peak at a location of the first client device, a second transmission peak at a location of the second client device, and a first transmission null at a location of a third device”	
’376 Patent: Claim 12	“determine where to place transmission peaks and transmission nulls within one or more spatially distributed patterns of electromagnetic signals based in part on the first and the second feedback information”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claim 12	“transmit the first data stream to the first client device via the one or more spatially distributed patterns of electromagnetic signals”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claim 12	“transmit the second data stream to the second	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	client device via the one or more spatially distributed patterns of electromagnetic signals”	describe or enable the full breadth of the claims.
’376 Patent: Claim 12	“wherein transmission of the first data stream and transmission of at least part of the second data stream occur at the same time”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claim 12	“wherein the one or more spatially distributed patterns of electromagnetic signals are configured to exhibit a first transmission peak at a location of the first client device, a second transmission peak at a location of the second client device, and a first transmission null at a location of a third device”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claim 22	“a processor configured to: generate a probing signal for transmission to at least a first client device and a second client device; generate a first data stream for transmission to the first client device; and generate a second data stream for transmission to the second client device; wherein . . . the processor . . . is further configured to: receive a first feedback information from the first client device;	<p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.</p> <p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 2 because the claim does not distinctly and particularly point out the invention.</p> <p>This claim limitation is subject to 35 U.S.C. § 112, ¶ 6, and is invalid under 35 U.S.C. § 112, ¶ 2 because the specification does not disclose corresponding structure linked to the claimed function.</p>

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	<p>wherein the first feedback information comprises one or more of: a first amplitude information, a first phase information, a first routing information, or a first index to a routing table;</p> <p>receive a second feedback information from the second client device;</p> <p>wherein the second feedback information comprises one or more of: a second amplitude information, a second phase information, a second routing information, or a second index to a routing table;</p> <p>determine where to place transmission peaks and transmission nulls within one or more spatially distributed patterns of electromagnetic signals based in part on the first and the second feedback information;</p> <p>transmit the first data stream to the first client device via the one or more spatially distributed patterns of electromagnetic signals;</p> <p>transmit the second data stream to the second client device via the one or more spatially distributed patterns of electromagnetic signals;</p> <p>wherein transmission of the first data stream and</p>	

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	transmission of at least part of the second data stream occur simultaneously; and wherein the one or more spatially distributed patterns of electromagnetic signals are configured to exhibit a first transmission peak at a location of the first client device and a second transmission peak at a location of the second client device”	
'376 Patent: Claim 22	“wherein the first feedback information comprises one or more of: a first amplitude information, a first phase information, a first routing information, or a first index to a routing table”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claim 22	“wherein the second feedback information comprises one or more of: a second amplitude information, a second phase information, a second routing information, or a second index to a routing table”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claim 22	“determine where to place transmission peaks and transmission nulls within one or more spatially distributed patterns of electromagnetic signals based in part on the first and the second feedback information”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claim 22, 32	“transmit the first data stream to the first client	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	device via the one or more spatially distributed patterns of electromagnetic signals”	describe or enable the full breadth of the claims.
’376 Patent: Claim 22, 32	“transmit the second data stream to the second client device via the one or more spatially distributed patterns of electromagnetic signals”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claim 22, 32	“wherein transmission of the first data stream and transmission of at least part of the second data stream occur simultaneously”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claim 22	“wherein the one or more spatially distributed patterns of electromagnetic signals are configured to exhibit a first transmission peak at a location of the first client device and a second transmission peak at a location of the second client device”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claim 24	“determine a second set of weights to apply to the one or more spatially distributed patterns of electromagnetic signals, wherein the first set of weights and the second set of weights are different”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claim 27	“determine a second set of weights to apply to the one or more spatially distributed patterns of electromagnetic signals, wherein the first set of weights and the second set of weights are different”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
'376 Patent: Claim 28	"modify the one or more spatially distributed patterns of electromagnetic signals based on adjustment of the second set of weights to the one or more spatially distributed patterns of electromagnetic signals"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claim 28	"transmit a fourth data stream to the second client device via the modified one or more spatially distributed patterns of electromagnetic signals"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claim 30	"comprising a memory, wherein the determination of where to place the transmission peaks and the transmission nulls within one or more spatially distributed patterns of electromagnetic signals is further based partly on information contained within the routing table, wherein the routing table is stored in the memory"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claim 31	"wherein the routing table comprises weighting values"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'376 Patent: Claim 32	"a processor configured to: generate a probing signal for transmission to at least a first client device and a second client device; generate a first data stream for transmission	<p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.</p> <p>The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 2 because the claim does not distinctly and particularly point out the invention.</p>

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	<p>to the first client device; and generate a second data stream for transmission to the second client device; wherein . . . the processor . . . is further configured to: receive a first feedback information from the first client device; wherein the first feedback information comprises one or more of: a first amplitude information, a first phase information, a first routing information, or a first routing table index; receive a second feedback information from the second client device; wherein the second feedback information comprises one or more of: a second amplitude information, a second phase information, a second routing information, or a second routing table table; determine where to place transmission peaks and transmission nulls within one or more spatially distributed patterns of electromagnetic signals based in part on the first feedback information and the second feedback information; transmit the first data stream to the first client</p>	<p>This claim limitation is subject to 35 U.S.C. § 112, ¶ 6, and is invalid under 35 U.S.C. § 112, ¶ 2 because the specification does not disclose corresponding structure linked to the claimed function.</p>

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	device via the one or more spatially distributed patterns of electromagnetic signals; transmit the second data stream to the second client device via the one or more spatially distributed patterns of electromagnetic signals; wherein transmission of the first data stream and transmission of at least part of the second data stream occur simultaneously; and wherein the one or more spatially distributed patterns of electromagnetic signals are configured to exhibit a first transmission peak at a location of the first client device, a second transmission peak at a location of the second client device, and a first transmission null at a location of a third device”	
’376 Patent: Claim 32	“a memory operatively coupled to one or more of the processor or the transceiver”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claim 32	“wherein a routing table is stored in the memory”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claim 32	“wherein the first feedback information comprises one or more of: a first amplitude	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	information, a first phase information, a first routing information, or a first routing table index”	
’376 Patent: Claim 32	“wherein the second feedback information comprises one or more of: a second amplitude information, a second phase information, a second routing information, or a second routing table table”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claim 32	“determine where to place transmission peaks and transmission nulls within one or more spatially distributed patterns of electromagnetic signals based in part on the first feedback information and the second feedback information”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’376 Patent: Claim 32	“wherein the one or more spatially distributed patterns of electromagnetic signals are configured to exhibit a first transmission peak at a location of the first client device, a second transmission peak at a location of the second client device, and a first transmission null at a location of a third device”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’511 Patent: Claims 1, 10	“m antenna arrays configured to receive a propagating radio frequency signal and configured to transmit a propagating radio frequency signal, each of	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	the antenna arrays comprising: a plurality of antenna elements; and a beamformer configured to produce n different bi-directional beams using the plurality of antenna elements”	
’511 Patent: Claims 1, 10	“n multiple-input multiple-output transceivers (MIMO), each MIMO transceiver comprising: a MIMO receiver configured to process m different received signals, wherein an i-th received signal to a j-th MIMO receiver corresponds to a j-th beam of an i-th antenna array; and a MIMO transmitter configured to process m different transmit signals, wherein a v-th transmit signal from a z-th MIMO transmitter corresponds to a z-th beam of a v-th antenna array; wherein m, n, v, and z are integer number values, wherein $i=1, \dots, m$, $j=1, \dots, n$, and $v=1, \dots, m$, wherein $n \geq 2$ and $m \geq 2$, wherein $z=1, \dots, w$, and wherein $n \geq w \geq 2$ ”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims. The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 2 because the claim does not distinctly and particularly point out the invention.
’511 Patent: Claims 2, 11	“substantially comply with one or more of Electrical and Electronic Engineers (IEEE) 802.11a/b/g/n/ac (WiFi), IEEE 802.16 (WiMAX), 2nd Generation Partnership Project	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	(3GPP) Long Term Evolution (LTE), 3GPP LTE-Advanced, 3GPP LTE-TDD, 3GPP LTE-FDD, High Speed Packet Access (HSPA), and HSPA+”	
’511 Patent: Claims 4, 13	“wherein the m antenna arrays are separated by a distance more than one wavelength apart at the carrier frequency”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’511 Patent: Claims 5, 14	“wherein the antenna elements are less than or equal to one half wavelength apart at the carrier frequency”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’511 Patent: Claims 6, 15	“wherein the beamformer is an electronic beamformer”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’511 Patent: Claims 9, 18	“wherein the system simultaneously provides MIMO and beamforming”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’511 Patent: Claim 19	“m antenna arrays configured to receive a propagating radio frequency signal, each of the antenna arrays comprising: a plurality of antenna elements; and a beamformer configured to produce n different receive beams using the plurality of antenna elements”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’511 Patent: Claim 19	“n multiple-input multiple-output receivers (MIMO), each MIMO receiver configured to	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	process m different received signals, wherein an i-th received signal to a j-th MIMO receiver corresponds to a j-th beam of an i-th antenna array, wherein m and n are integer number values, and wherein $i=1, \dots, m$, and $j=1, \dots, n$, and wherein $n \geq 2$ and $m \geq 2$	
'511 Patent: Claim 20	"m antenna arrays configured to transmit a propagating radio frequency signal, each of the antenna arrays comprising: a plurality of antenna elements; and a beamformer configured to produce n different transmit beams using the plurality of antenna elements"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'511 Patent: Claim 20	"n multiple-input multiple-output transmitters (MIMO), each MIMO transmitter configured to process m different transmit signals, wherein a v-th transmit signal from a z-th MIMO transmitter corresponding to a z-th beam of a v-th antenna array is selected for transmission, wherein m, n, v, and z are integer number values, and wherein $z=1, \dots, n$, and $v=1, \dots, m$, and wherein $n \geq 2$ and $m \geq 2$ "	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'369 Patent: Claim 1	"identifying at least one	The claim is invalid under pre-AIA 35 U.S.C. §

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	multipath transmission delay within a reverse path data signal received from a receiving device”	112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’369 Patent: Claim 1	“determining at least one forward path pre-equalization parameter based on said at least one transmission delay”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’369 Patent: Claim 1	“modifying a forward path data signal that is to be transmitted to the receiving device based on said at least one forward path pre-equalization parameter, where said modifying includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’369 Patent: Claim 2	“receiving said reverse path data signal over at least one reverse transmission path”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’369 Patent: Claim 3	“transmitting said modified forward path data signal over at least one forward transmission path”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’369 Patent: Claim 4	“wherein said reverse path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	Phase Shift Keying (QPSK) data”	
’369 Patent: Claim 5	“wherein said modified forward path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’369 Patent: Claim 6	“wherein said modified forward path data signal includes sub-carrier pre-equalized OFDM data”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’369 Patent: Claim 7	“generating corresponding Quadrature Phase Shift Keying (QPSK) modulation values based on said sub-carrier pre-equalized OFDM data”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’369 Patent: Claim 9	“wherein said reverse path data signal includes identifiable training data”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’369 Patent: Claim 10	“comparing said identifiable training data to a local version of said training data to identify said at least one multipath transmission delay within said reverse path data signal”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
’369 Patent: Claim 12	“wherein said at least one reverse transmission path is substantially reciprocal to said at least one forward transmission path”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
'369 Patent: Claim 13	"wherein identifying said at least one multipath transmission delay, determining said at least one forward path pre-equalization parameter, and modifying said forward path data signal are performed by a transmitting device"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'369 Patent: Claim 14	"wherein said transmitting device includes a base station device that is operatively configured for use in a wireless communication system"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'369 Patent: Claim 15	"using at least one transmitting device receive antenna operatively coupled to said transmitting device to receive said reverse path data signal over at least one reverse transmission path from the receiving device"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'369 Patent: Claim 19	"wherein said transmitting device is operatively coupled to a plurality of first device receive antennas"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'369 Patent: Claim 21	"wherein determining said at least one forward path pre-equalization parameter based on said at least one transmission delay further includes: determining at least one angle of arrival of said reverse path data signal with respect to said at least one transmitting device receive antenna"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
'369 Patent: Claim 28	"using at least one transmitting device transmit antenna operatively coupled to said transmitting device to transmit said modified forward path data signal over at least one forward transmission path to the receiving device"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'369 Patent: Claim 32	"setting at least one antenna pointing parameter associated with said at least one transmitting device transmit antenna based on said at least one forward path pre-equalization parameter"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'369 Patent: Claim 33	"setting at least one phased array antenna transmission directing parameter associated with said at least one transmitting device transmit antenna based on said at least one forward path pre-equalization parameter"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'369 Patent: Claim 35	"selecting said at least one transmitting device transmit antenna from a plurality of transmitting device transmit antennas that are each operatively coupled to said transmitting device"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'369 Patent: Claim 36	"selectively transmitting a plurality of beams using two or more transmitting device transmit antennas"	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.
'369 Patent: Claim 37	"wherein each of said transmitted plurality of beams is selectively	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the

Asserted Claim(s)	Claim Term	Invalidity Under 35 U.S.C. § 112
	adjusted in phase and amplitude to reduce multipath affects when received by said receiving device”	claims.
’369 Patent: Claim 41	“wherein determining said at least one forward path pre-equalization parameter based on said at least one transmission delay further includes: sub-band equalizing said forward path data signal using corresponding frequency domain reverse path data”	The claim is invalid under pre-AIA 35 U.S.C. § 112, ¶ 1 because the specification fails to describe or enable the full breadth of the claims.

These are merely examples and are not intended to be limiting. Defendants reserve all rights to amend their Invalidity Contentions under 35 U.S.C. § 112, including after an Asserted Claim is ultimately construed by the Court, in response to any interpretation of an Asserted Claim embodied in XR’s infringement positions, and/or to account for any changes in the law concerning invalidity under 35 U.S.C. §112. Defendants additionally reserve the right to provide additional explanation and/or argument for their Invalidity Contentions under § 112, including, for example, based on expert testimony.

III. P.R. 3-4 DISCLOSURES AND CONTENTIONS

A. P.R. 3-4(a) Disclosures

Pursuant to P.R. 3-4(a), Defendants are separately producing representative technical documentation within their possession, custody, and control that show the operation of aspects or elements of the Accused Instrumentality identified by XR in its Infringement Contentions for each Defendant. Defendants reserve the right to supplement these disclosures with additional documentation.

B. P.R. 3-4(b) Disclosures

In accordance with P.R. 3-4(b), Defendants are producing a single set of prior art references identified in these Invalidity Contentions for prior art related to patents asserted against more than one Defendant. Defendants are also producing prior art references concerning prior art systems and methods. Such documents can be found at the following Bates range: DEFS-PA_00000001 – DEFS-PA_00028746. Any prior art references not in English are produced with an English translation of the portion(s) relied upon. These prior art references are cited herein and support the contentions presented. Defendants' search for prior art references, additional documentation, and/or corroborating evidence concerning prior art apparatuses and methods is ongoing. Accordingly, Defendants reserve the right to supplement their production, as provided by the local rules, as additional prior art references, additional documentation, and/or corroborating evidence concerning prior art documents/apparatuses, and methods are obtained during the course of discovery.

Dated: December 3, 2024

Respectfully submitted,

/s/ Matthew S. Yungwirth
Melissa Smith (TX SBN 24001351)
melissa@gillamsmith.com
GILLAM & SMITH, LLP
303 South Washington Avenue
Marshall, Texas 75670
Telephone: 903.934.8450

Matthew S. Yungwirth
msyungwirth@duanemorris.com
Alice E. Snedeker
aesnedeker@duanemorris.com
John R. Gibson
jrgibson@duanemorris.com
Duane Morris LLP
1075 Peachtree Street NE

Suite 1700
Atlanta, Georgia 30309
T: (404)-253-6900

Counsel for Defendant T-Mobile USA, Inc.

/s/ Matthew S. Yungwirth

Deron R. Dacus (TX SBN 00790553)
ddacus@dacusfirm.com
THE DACUS FIRM, P.C.
821 ESE Loop 323, Suite 430
Tyler, Texas 75701
Telephone: 903.705.1117

Matthew S. Yungwirth
msyungwirth@duanemorris.com
Alice E. Snedeker
aesnedeker@duanemorris.com
John R. Gibson
jrgibson@duanemorris.com
Duane Morris LLP
1075 Peachtree Street NE
Suite 1700
Atlanta, Georgia 30309
T: (404)-253-6900

Counsel for Defendant Ericsson Inc.

/s/ Matthew S. Yungwirth

Deron R. Dacus (TX SBN 00790553)
ddacus@dacusfirm.com
THE DACUS FIRM, P.C.
821 ESE Loop 323, Suite 430
Tyler, Texas 75701
Telephone: 903.705.1117

Matthew S. Yungwirth
msyungwirth@duanemorris.com
Alice E. Snedeker
aesnedeker@duanemorris.com
John R. Gibson
jrgibson@duanemorris.com

Duane Morris LLP

1075 Peachtree Street NE
Suite 1700
Atlanta, Georgia 30309
T: (404)-253-6900

*Counsel for Defendant Nokia of America
Corporation*

/s/ Matthew S. Yungwirth

Deron R. Dacus
ddacus@dacusfirm.com
THE DACUS FIRM, PC
821 ESE Loop 323
Suite 430
Tyler, Texas 75701
Telephone: (903) 705-1117
Facsimile: (903) 581-2543

Matthew S. Yungwirth
msyungwirth@duanemorris.com
Alice E. Snedeker
aesnedeker@duanemorris.com
John R. Gibson
jrgibson@duanemorris.com

Duane Morris LLP

1075 Peachtree Street NE
Suite 1700
Atlanta, Georgia 30309
T: (404)-253-6900

*Counsel for Defendants Verizon Communications
Inc. and Cellco Partnership d/b/a Verizon Wireless*

/s/ Matthew S. Yungwirth

Deron R. Dacus (TX SBN 00790553)
ddacus@dacusfirm.com
THE DACUS FIRM, P.C.
821 ESE Loop 323, Suite 430
Tyler, Texas 75701
Telephone: 903.705.1117

Matthew S. Yungwirth

msyungwirth@duanemorris.com
Alice E. Snedeker
aesnedeker@duanemorris.com
John R. Gibson
jrgibson@duanemorris.com
Duane Morris LLP
1075 Peachtree Street NE
Suite 1700
Atlanta, Georgia 30309
T: (404)-253-6900

*Counsel for Defendants AT&T Services Inc.,
AT&T Mobility LLC, and AT&T Corp.*

CERTIFICATE OF SERVICE

I hereby certify that on December 3, 2024, the foregoing document was served via e-mail upon all counsel of record in this case.

/s/ Sajid Saleem
Sajid Saleem